US Army Corps of Engineers
Waterways Experiment Station



Technical Report CERC-95-15
September 1995

# Los Angeles and Long Beach Harbors, Physical Model Study for Harbor Resonance of the Operations, Facilities, and Infrastructure, Scheme B, 2020 Plan

*by William C. Seabergh, Leonette J. Thomas*





Prepared for Port of Los Angeles
and Port of Long Beach

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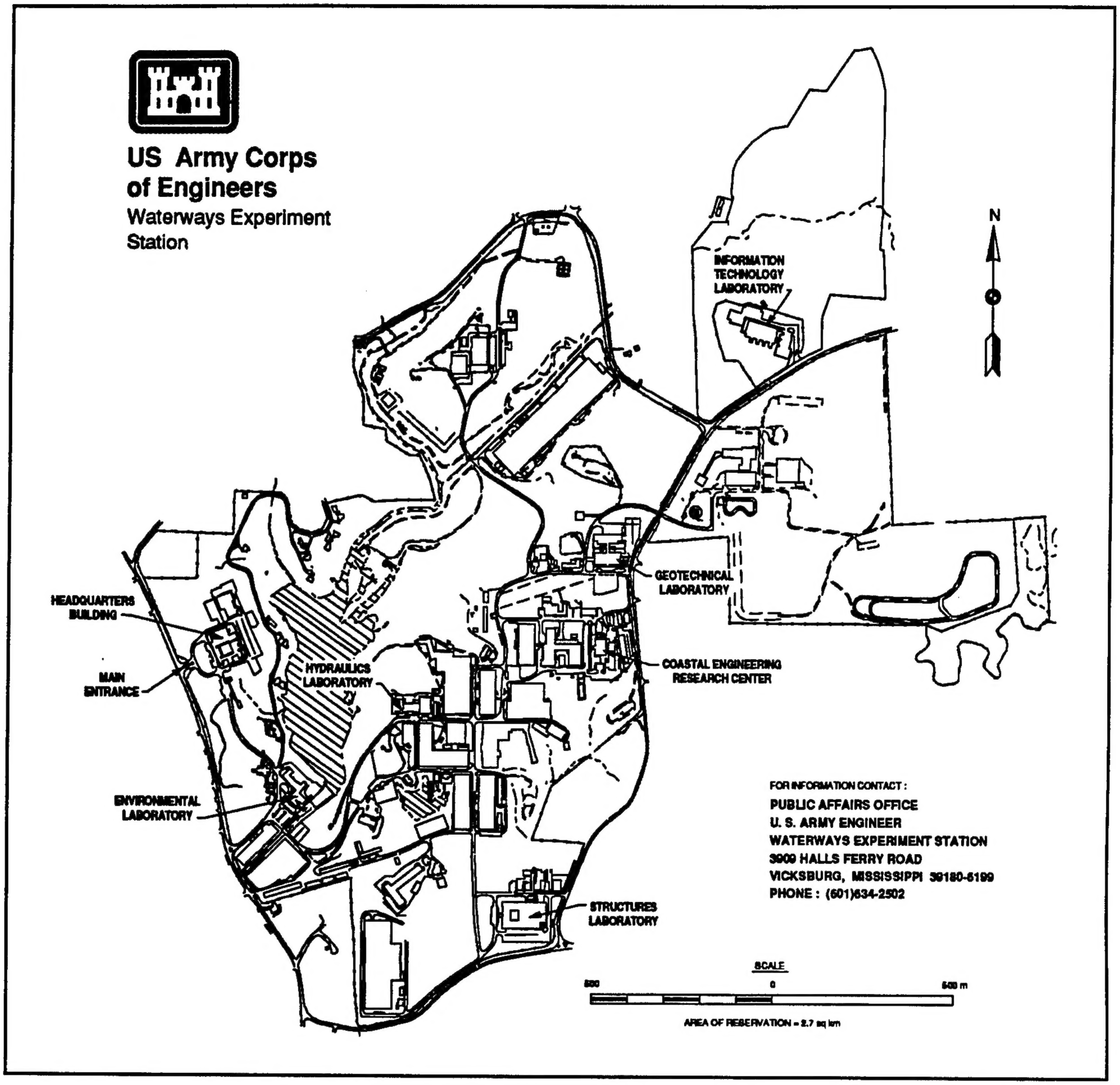
| A-1 | |

Final report

Approved for public release; distribution is unlimited

Prepared for Port of Los Angeles
San Pedro, CA 90733-0151
and Port of Long Beach
Long Beach, CA 90801-0570




**Waterways Experiment Station Cataloging-in-Publication Data**

Seabergh, William C.

Los Angeles and Long Beach Harbors, physical model study for harbor resonance of the operations, facilities, and infrastructure. Scheme B, 2020 Plan / by William C. Seabergh, Leonette J. Thomas ; prepared for Port of Los Angeles and Port of Long Beach.

298 p. : ill. ; 28 cm. -- (Technical report ; CERC-95-15)

Includes bibliographic references.

1. Harbors -- California -- Los Angeles -- Hydrodynamics. 2. Hydraulic models. 3. Ocean waves -- Simulation methods. 4. Water waves -- Simulation methods. I. Thomas, Leonette J. II. United States. Army. Corps of Engineers. III. U.S. Army Engineer Waterways Experiment Station. IV. Coastal Engineering Research Center (U.S. Army Engineer Waterways Experiment Station) V. WORLDPORT LA. VI. Port of Long Beach. VII. Title. VIII. 2020 plan. IX. Series: Technical report (U.S. Army Engineer Waterways Experiment Station) ; CERC-95-15.

TA7 W34 no.CERC-95-15

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# Preface

This report was prepared by the Coastal Engineering Research Center (CERC) at the U.S. Army Engineer Waterways Experiment Station (WES) and was funded jointly by the Ports of Los Angeles and Long Beach (LA/LB). Authorization to conduct a physical model investigation of the Operations, Facilities, and Infrastructure Study, Scheme B, 2020 Plan was received in September 1989. In response to the expansion of oceanborne world commerce, the Ports of LA/LB are conducting planning studies for harbor development in coordination with the U.S. Army Corps of Engineers District, Los Angeles (SPL). Ports are a natural resource, and enhanced port capacity is vital to the Nation's economic well-being. In a feasibility study being conducted by SPL, the Ports of LA/LB are proposing a well-defined and necessary expansion to accommodate predicted needs in the near future. The Corps of Engineers will be charged with responsibility for providing deeper channels and determining effects of this construction on the local environment. This includes changes in harbor resonance caused by expansion and channel deepening.

The investigation was conducted during the period March 1990 through March 1991 by personnel of the Wave Processes Branch (WPB), Wave Dynamics Division (WDD), CERC. WPB personnel involved in the study were Mr. William C. Seabergh, Ms. Leonette J. Thomas, and Mr. Larry A. Barnes, under the direct supervision of Mr. Dennis G. Markle, Chief, WPB, and Mr. C. E. Chatham, Chief, WDD. Mr. Seabergh and Ms. Thomas prepared this report. Ms. Debbie Fulcher, WDD, Ms. Bettie Flagg, WPB, and Ms. Jodie Denson, WPB, assisted in preparation of the final report and Mr. Rick Floyd, Instrumentation Services Division, provided electronics technical support. This study was conducted under the general supervision of Dr. James R. Houston, Director, CERC, and Mr. Charles C. Calhoun, Jr., Assistant Director, CERC.

During the course of the study, liaison was maintained between WES and the ports. Mr. John Warwar and Mr. Dick Wittkop, Port of Los Angeles, and Mr. Michael Burke, followed by Mr. Angel Fuertes, Port of Long Beach, were points of contact for the ports and provided invaluable assistance.

Dr. Robert W. Whalin was Director of WES at the time of publication of this report. COL Bruce K. Howard, EN, was Commander.

# Conversion Factors, Non-SI to SI Units of Measurement

Non-SI units of measurement used in this report can be converted to SI units as follows:

| Multiply | By | To Obtain |
|---|---|---|
| acres | 4046.8564 | square metres |
| feet | 0.3048 | metres |
| square feet | 0.09290304 | square metres |
| square miles | 2.589998 | square kilometres |
| miles (US nautical) | 1.852 | kilometres |

# 1 Introduction

## Objective

The Ports of Los Angeles and Long Beach on the southern California coast (see Figure 1) have undertaken a long-range, cooperative planning effort known as the 2020 Plan to meet international needs for increases in Pacific rim trade. This plan will provide facilities to meet projected cargo handling needs of the ports. A phased program of dredging, landfills, and facilities construction is anticipated. The Operations, Facilities and Infrastructure (OFI) Study has evaluated and quantified requirements for future construction. Specific layouts were developed and selected for detailed examination. Scheme B (Figure 2) is such a layout. It provides approximately 9,712,455 sq m (2,400 acres)[1] of new landfill and 38 new terminals. The objective of this physical model study was to determine harbor resonance characteristics of proposed berths and the effects of changes in harbor configuration on existing harbor facilities.

## Background

A physical scale model of Los Angeles and Long Beach Harbors was constructed at the U.S. Army Engineer Waterways Experiment Station in 1973. This 1:400 horizontal, 1:100 vertical scale model (Figure 3) was designed to reproduce tides and waves. Since 1973, the model has been used to examine the effects of harbor expansion projects on tidal currents and harbor resonance. More recently it has been used exclusively for performing harbor resonance tests with simulation of long-period waves. These tests involve the construction of proposed projects in the model and subjecting them to a series of over 200 monochromatic wave tests, with wave periods ranging from 30 to 400 sec. Wave data usually are collected at 50 or more locations throughout the harbors at existing and proposed berths (see Seabergh (1985), for example). As part of a recently completed Model Enhancement Program, the model was provided with spectral long-period wave testing capability (Seabergh and Thomas,

[1] A table of factors for converting non-SI units of measurement to SI (metric) units can be found on page vii.

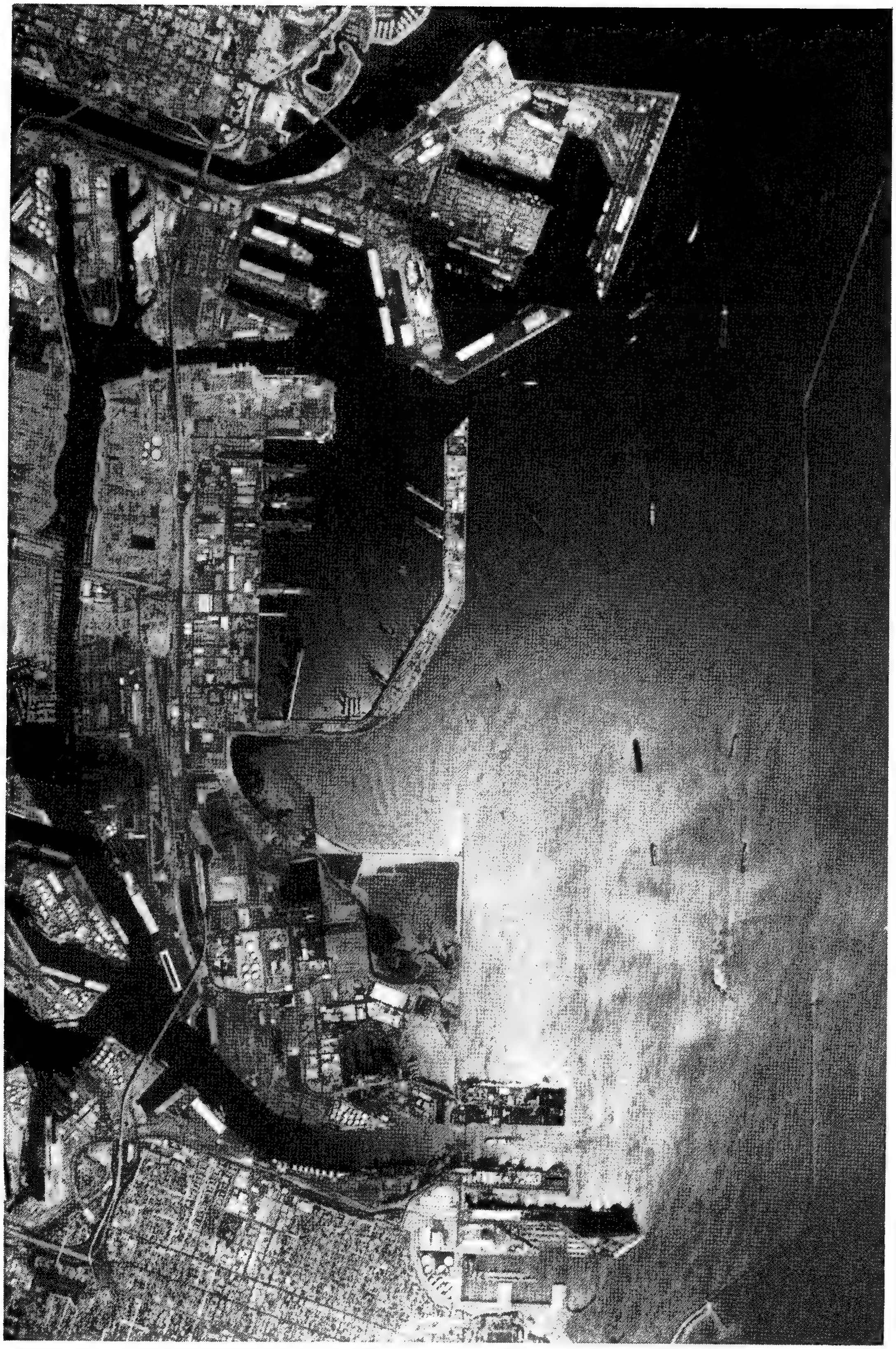

Figure 1. Ports of Los Angeles and Long Beach (1984)

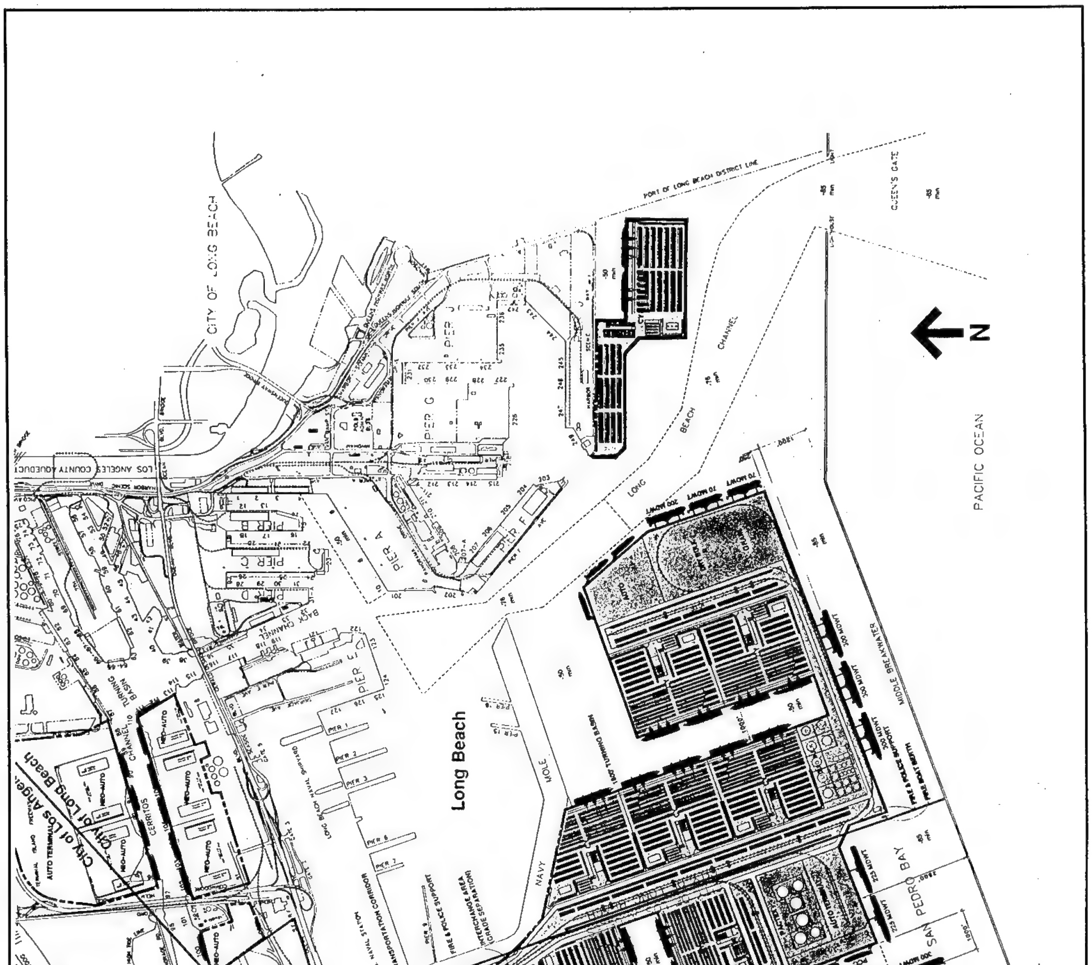


Figure 2. OFI Scheme B

Figure 3. The model with OFI Scheme B

1993). Using prototype long-period wave data collected offshore of the harbors, it was possible to develop long-period wave spectra which could be input to the computer-controlled model wave generators. This approach permits a broad range of periods (or frequencies) to be reproduced simultaneously for an individual test. These results are used to define troublesome wave period ranges, which create harbor surge that may lead to difficult loading/unloading conditions and possible ship damage. Tests then may be conducted with monochromatic waves at a finer resolution to provide input to a numerical moored ship motion model.

A preliminary numerical model study of the 2020 plan is reported upon in Sargent (1989).

# 2 The Los Angeles - Long Beach Harbors Physical Model

## Model Description

The Los Angeles and Long Beach Harbors model was molded in concrete grout at a vertical scale of 1:100 and a horizontal scale of 1:400 and reproduced San Pedro Bay and the Pacific Ocean seaward of the harbor out to the -91.44-m (-300-ft) mean lower low water (mllw) contour. The model shoreline extended from 3.2 km (2 miles) northwest of Point Fermin to Huntington Beach. The total area reproduced in the model covered about 474 sq m (44,000 sq ft), representing 655 sq km (253 sq miles) in the prototype. Model layout is shown in Figure 4, and Figure 5 shows the harbor basins and the channels reproduced in the model.

The model was originally constructed to conditions as they existed in the early 1970's and has been periodically updated. For this work, care was taken to ensure that the latest bathymetry and harbor geometry were in place. The Long Beach Harbor, Pier J expansion and associated increased channel depths, which were completed in 1992, also were included in the definition of current conditions.

## Model Design Conditions

During initial model design a number of specific investigations were made to aid in selection of model scales and to ensure accurate reproduction of long-period wave phenomena. Details are found in Outlaw et al. (1977). A listing of items studied follows:

*a.* Wave refraction.

*b.* Energy transmission through the breakwaters.

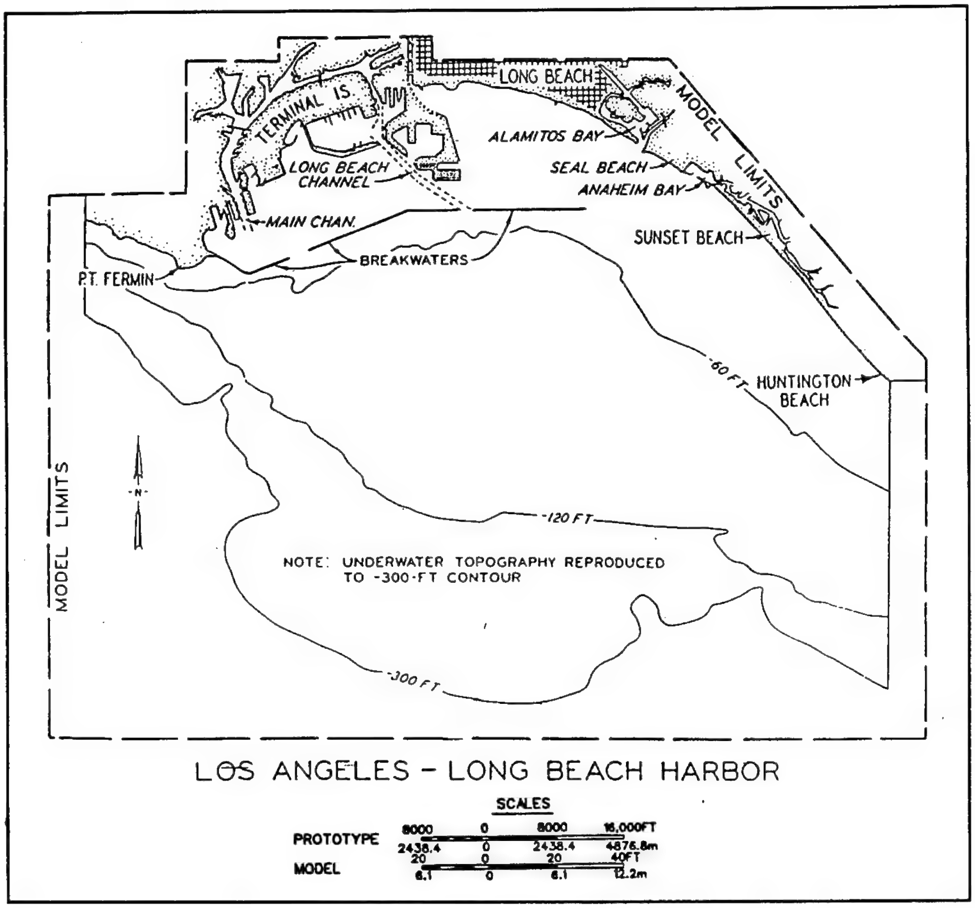


Figure 4. Model layout

*c.* Wave diffraction.

*d.* Reflection from offshore bathymetry and harbor boundaries.

*e.* Model wave filters and absorbers.

*f.* Model wave height attenuation.

Items *a.* and *c.* are important wave phenomena that govern how wave energy is distributed along the coast and throughout the harbors. Both cannot be exactly scaled simultaneously in a distorted scale model; however, due to the nature of long-period waves, a solution can be found for exact scaling of diffraction and exact scaling of refraction down to the 85-sec wave period, below which adjustments to wave generator position can be made to correctly reproduce refraction. A brief discussion of this follows.

Diffraction is the phenomenon in which energy is transmitted laterally along a wave crest, as when waves propagate into the lee of a structure. It is a function of $x/L$ or $y/L$ (the ratio of horizontal distance to wavelength $L$). Refraction is the process by which wave direction and amplitude are changed

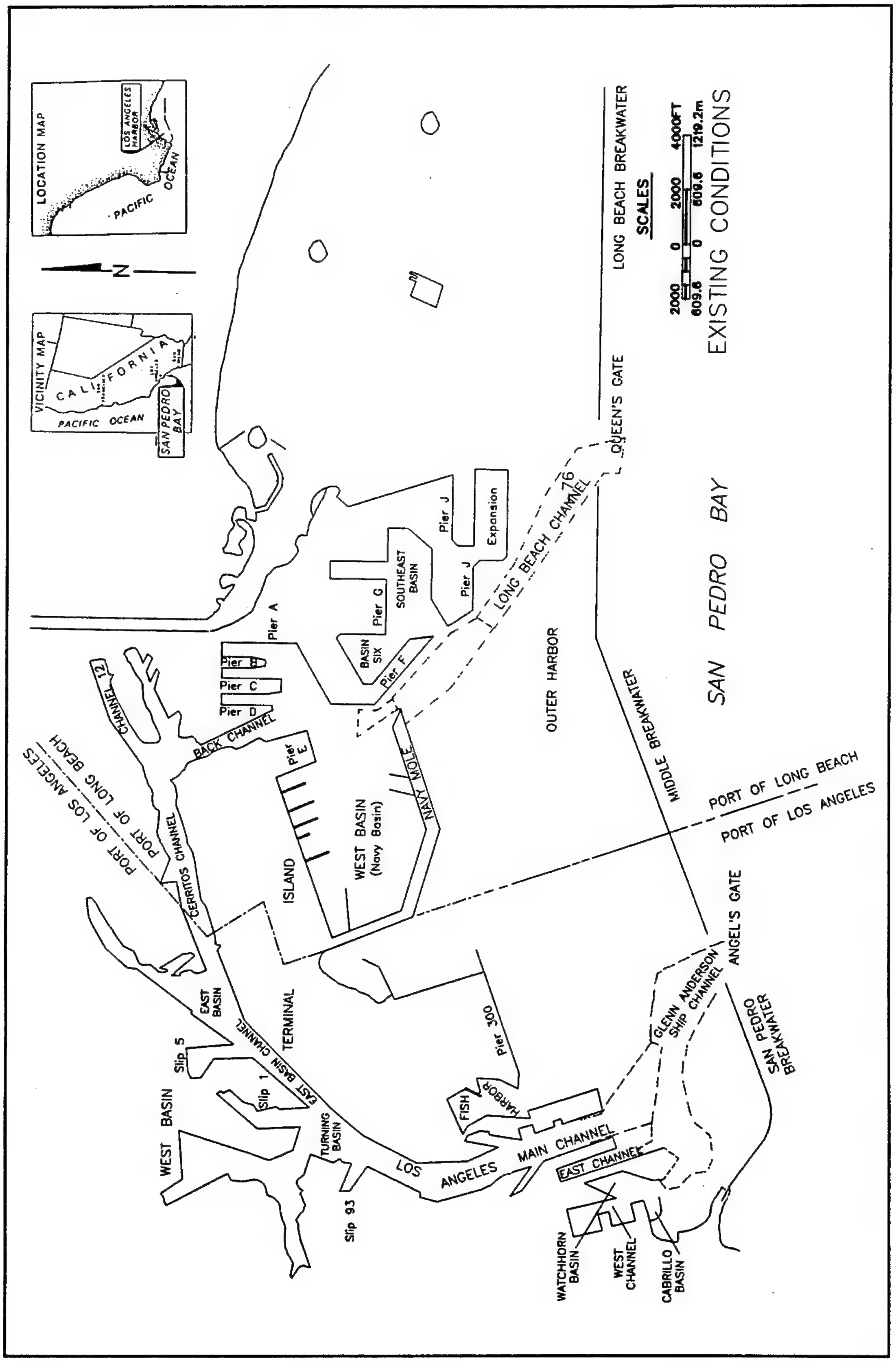


Figure 5. Los Angeles and Long Beach Harbors layout

due to the part of the wave in shallower water advancing more slowly than that in deeper water. Refractive effects depend on wave celerity and are a function of *h/L* (the ratio of water depth *h* to wavelength). Consequently, if wavelength is scaled by the vertical scale in a distorted scale model, refraction is in exact similitude. If wavelength is scaled by the horizontal scale, diffraction is in exact similitude. Furthermore, in the Los Angeles - Long Beach Harbors model study it is desired to obtain similitude of mode shapes and resonant frequencies of oscillation. The governing Helmholtz equation for harbor oscillations is

$$\frac{\partial}{\partial x}\left(h\frac{\partial \eta}{\partial x}\right) + \frac{\partial}{\partial y}\left(h\frac{\partial \eta}{\partial y}\right) + \frac{\sigma^2}{g}\eta = 0 \tag{1}$$

where

x,y,z = axes of a rectangular coordinate system fixed at the mean water surface

$\eta$ = local surface elevation

$\sigma$ = angular frequency

g = acceleration due to gravity

Since the same equation applies in model and prototype, it may be written as

$$\left(h_r\frac{\eta_r}{x_r^2}\right)\frac{\partial}{\partial x_p}\left(h_p\frac{\partial \eta_p}{\partial x_p}\right) + \left(h_r\frac{\eta_r}{y_r^2}\right)\frac{\partial}{\partial y_p}\left(h_p\frac{\partial \eta_p}{\partial y_p}\right) + \eta_r\sigma_r^2\left(\frac{\sigma_p^2}{g}\right)\eta_p = 0 \tag{2}$$

where the subscript *p* represents the prototype and the subscript *r* represents the scale ratio of model to prototype. From inspectional analysis, the coefficients of the above equation must be equal, or

$$\frac{h_r}{x_r^2} = \frac{h_r}{y_r^2} = \sigma_r^2 \tag{3}$$

after dividing by $\eta$ . This indicates that a hydraulic model may be distorted for proper simulation of harbor resonant oscillation frequencies. The angular frequency may be written in terms of wavelength and water depth and this equation indicates that wavelength must be scaled by the horizontal scale.

From the previous paragraph it was determined that when wavelength is scaled by the horizontal scale, diffraction and harbor resonance conditions will be in similitude. However, refraction can have a scale effect due to model distortion, but if the wave is a shallow-water wave where wave celerity is governed by local depth, model distortion will have little effect on refraction. This is seen from the equation for wave celerity $c$, from small-amplitude wave theory

$$c = \left(\frac{gL}{2\pi}\tanh\frac{2\pi h}{L}\right)^{\frac{1}{2}} \tag{4}$$

As the wave period increases, *tanh* $2\pi h/L$ approaches $2\pi h/L$, and the celerity becomes

$$C = (gh)^{\frac{1}{2}} \tag{5}$$

This indicates that for shallow-water waves, celerity (and thus refraction) is independent of wavelength, and the use of model distortion has no significant effect on wave refraction.

Based on Froudian similitude, the time scale for model wave period, using a horizontal scale for wave length as shown earlier, is written as (Outlaw et al. 1977)

$$T_r = \left[L_r \frac{\tanh\left(\frac{2\pi}{L_p}h_p\right)}{\tanh\left(\frac{2\pi}{L_m}h_m\right)}\right]^{\frac{1}{2}} \tag{6}$$

with the subscript $m$ referring to the model. As *tanh* $(2\pi h/L)$ approaches $(2\pi h/L)$, the time scale ratio can be approximated by

$$T_r = \frac{L_r}{(h_r)^{\frac{1}{2}}} \tag{7}$$

which when applicable, indicates a model-to-prototype time scale of 1:40 for wave period.

## Model Appurtenances

*Wave generator.* The electrohydraulic wave generator was composed of 13 segments, each independently controlled from a computer-generated command signal and equipped with a 4.57-m (15-ft) paddle. The segments can be positioned to approximate a curved wavefront 23,774 m (78,000 ft) long (prototype). Details of generator design are found in Outlaw et al. (1977).

## Data Acquisition

Wave data acquisition, wave generator control signals and feedback, and wave gauge calibration were performed using an Automated Data Acquisition and Control System (ADACS). A schematic is shown in Figure 6. At the heart of the system is a Digital Equipment Corporation Microvax computer. Wave data are collected at various locations throughout the model. The ADACS can handle 30 gauges for a test run. The sensor used is a water-surface-piercing parallel-rod resistance type wave gauge where the conductance between the two rods is measured and is directly proportional to submergence. This system can detect changes in water elevation to 0.03048 cm (0.001 ft).

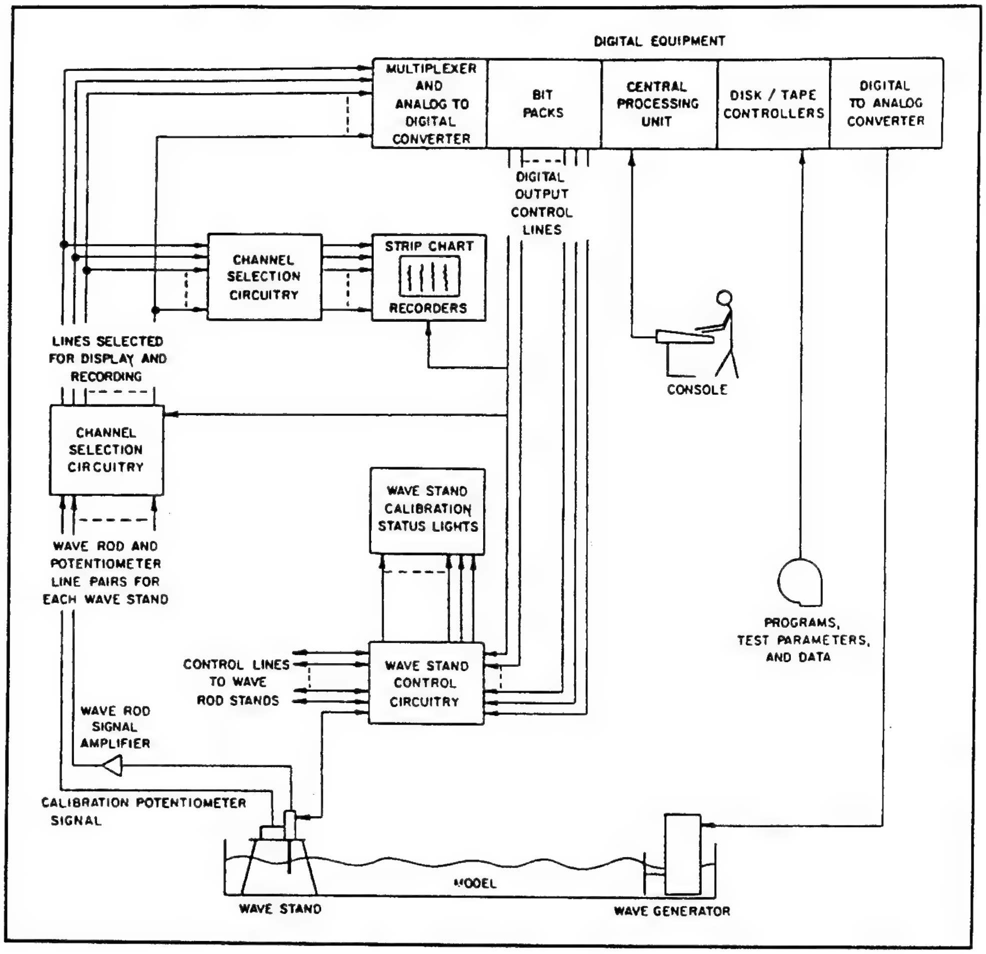


Figure 6. Automated data acquisition and control system (ADACS)

# 3 Test Conditions

## Plans Tested

The OFI Scheme B harbor plan was divided into two phases, with Phase I the initial configuration to be constructed, followed by Phase II. Figures 7 and 8 show these layouts and the location of wave gauges.

## Testing and Data Analysis Procedures

As discussed earlier, model testing for harbor resonance can be conducted using monochromatic or spectral waves. Both approaches were used for this study and the results are reported in terms of wave height amplification. Model wave height data were collected at the locations seen in Figures 7 and 8 (for Phases I and II, respectively). These wave heights typically are converted to a wave height amplification. Wave height amplification is sometimes defined (but not used for this study) as the ratio of the wave height at a particular location in a harbor to twice the incident wave height at the harbor mouth. This definition results from the fact that the standing wave height for a fully reflective straight coast with no harbor would be twice the incident wave height due to superposition of the incident and reflected waves. However, in the hydraulic model there is variation in wave height along the harbor boundary due to wave refraction. In the previous Los Angeles - Long Beach Harbor resonance studies, incident wave height in deep water is used and amplification $R$ is defined as

$$R=H_s/H_i \tag{8}$$

$H_s$ = significant wave height at gauge in harbor

$H_i$ = deepwater incident wave height

In this study, data were available at the ocean wave gauge on Platform Edith. In order to facilitate direct comparison with prototype data for model verification, wave height data at each harbor gauge were divided by wave height

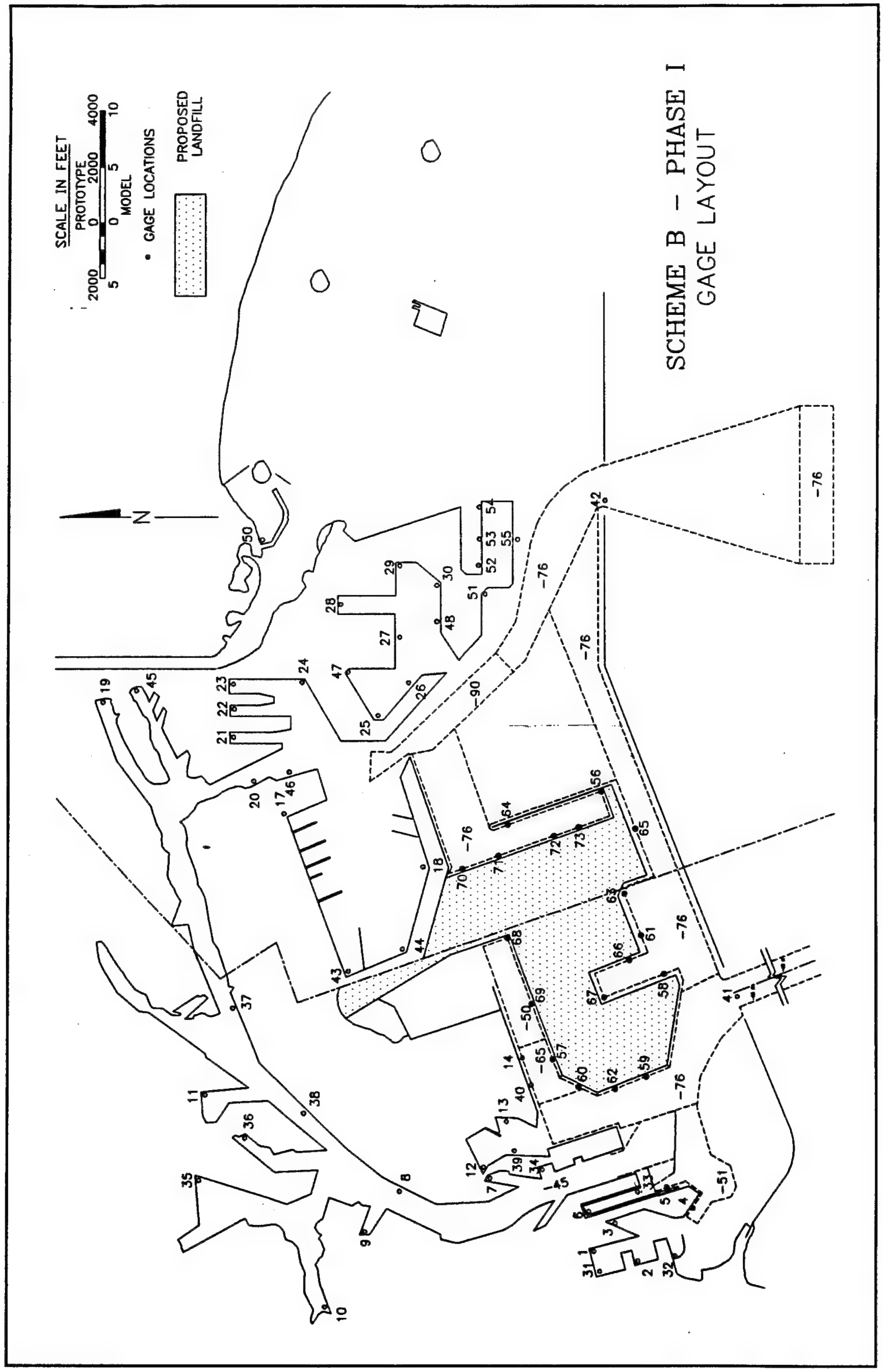


Figure 7. Wave gauge locations for Scheme B, Phase I

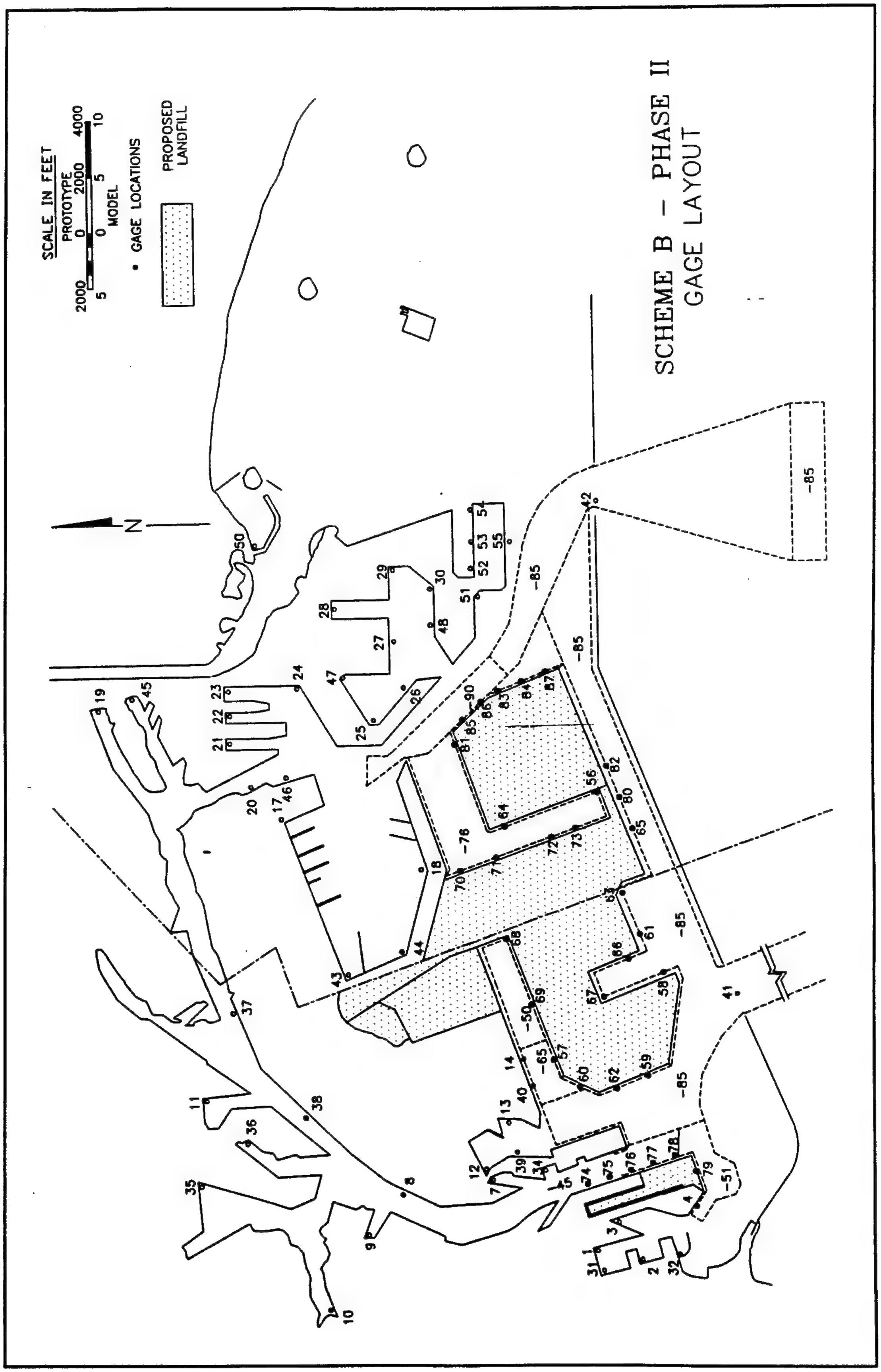


Figure 8. Wave gauge locations for Scheme B, Phase II

measured at a gauge located at the analogous location of Platform Edith in the model ocean. The Platform Edith prototype ocean gauge is located 14.8 km (8 miles) south of Long Beach Harbor's Queens Gate. Since the waves being studied were composed of many frequencies (or a spectrum), the digital output from the gauge was analyzed by Fast Fourier Analysis (FFT) to determine an energy level that could be converted to a wave height (by taking four times the square root of the energy) for each frequency band. Water elevation data were collected at a rate of 20 readings per second at each gauge location. A total of 8,192 data points were collected at each gauge during a test. Data were windowed with a cosine square taper and after FFT analysis, the raw spectral estimates ($\Delta f$=0.0024414) were smoothed by averaging eight bands, so that $\Delta f$ for model data was 0.01953.

## Selection of Test Conditions

Platform Edith long-period wave data were analyzed to determine appropriate input to the model wave generators. Two storms were outstanding in the data record as far as their impact on the harbors. The largest event recorded was the Martin Luther King Day storm of 17 January 1988. The short-period portion of the wave spectrum had a significant wave height of 7.5 m (24.6 ft) during the peak period of energy measured at Platform Edith. The long-period portion of the wave spectrum contained 270 $cm^2$ (0.29 $ft^2$) of energy and was distributed as seen in Figure 9. This event caused significant damage to the southern California coastline. The second event selected occurred on 2 February 1986 and resulted in significant harbor agitation with numerous reports of moored ship difficulties (Figure 9 shows this long-wave spectrum). The third long-wave spectrum selected was based on an average or mean long-period wave spectrum condition representative of a southerly approach (Figure 9). Since the mean spectrum was nearly flat, a uniform, constant-energy spectrum was created for use in the model.

In order to transform the spectral representation into an actual time series of waves in the model, the program TSGMN3P0 takes the discreetly defined spectral energy (36 frequency components from 0.1 to 1.33 cps) and creates a control signal which has 256 frequency bands ($\Delta f$=0.00479) for the wave generator. The control signal is input to the program SPLASH, which will control the wave paddle to create the desired wave spectrum. In order to produce an analysis that accurately defines the energy in the broad range of wave periods contained in the long-period spectrum, each individual test was run for 512 sec. Runs of shorter test durations compared closely to the 512-sec test, indicating no problems with contamination of the wave records due to rereflected waves off model boundaries or the wave generator. The boundaries have multiple layers of a fibrous matrix wave absorber and the irregular ocean contours and shoreline boundary do not appear to direct significant energy back to the wave generator. The 13 individual units that make up the wave generator were operated in phase, but wave amplitude was varied along the wave front to create an appropriate energy distribution approaching the harbors. Since the

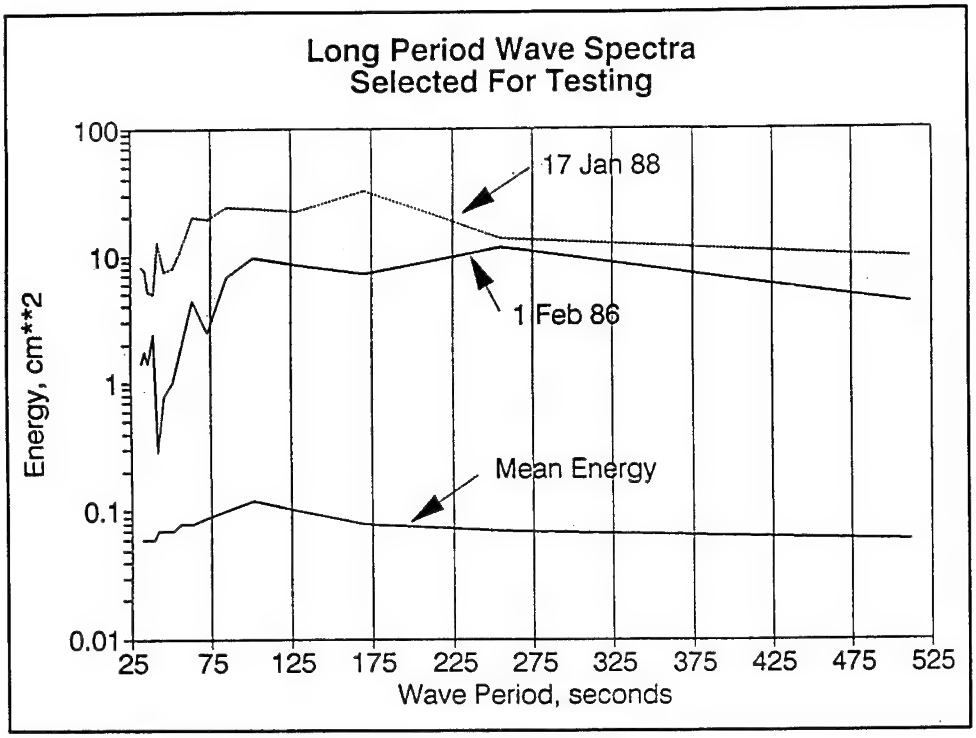


**Figure 9. Long-period wave spectra selected for testing**

two storms being run approached from a westerly quadrant, energy distribution was adjusted for that approach. The uniform-spectrum energy distribution was adjusted for a southerly wave approach, more typical of summer conditions. Ship motion observations in the prototype indicate that these two directional approaches (the west for winter storms, and the south for hurricane and Southern Hemisphere swell) create an annual bimodal distribution for significant moored ship motion events.

The model was updated to include the latest harbor configuration and after initial base data sets were collected, the Long Beach Harbor's Pier J expansion, with its associated channel deepening, was added in concurrence with its construction in the prototype.

# 4 Test Results

## Organization of Data

Wave gauge data (wave height amplifications) have been geographically grouped in gauge clusters as shown in Figure 10 for easier analysis. The clusters of gauges were named and each one contained the numbered gauges shown below:

| Cluster Name | Gauges in Cluster |
|---|---|
| LA Main Channel | 7, 8, 9, 10, 11, 34, 35, 36, 37, 38 |
| LA West | 1, 2, 3, 4, 5, 6, 31, 32, 33, 41 |
| LA Fish Harbor | 12, 13, 14, 39, 40 |
| LB Navy Basin | 17, 18, 43, 44 |
| LB Northeast | 19, 20, 21, 22, 23, 24, 45, 46 |
| LB Southeast | 25, 26, 27, 28, 29, 30, 47, 48 |
| LB East | 42, 50, 51, 52, 53, 54, 55 |
| LA Island | 57, 58, 59, 60, 61, 62, 63, 66, 67, 68, 69 |
| LB Island | 56, 64, 65, 70, 71, 72, 73, 80, 81, 82, 83, 84, 85, 86, 87 |
| LA New | 74, 75, 76, 77, 78, 79 |

The last three clusters, LA Island, LB Island, and LA New, are located at new berth locations and have no base data to compare with. Within each cluster group, average wave height amplification data are presented for the three individual test spectra. Wave height amplifications at each gauge location (for a given spectrum), were averaged for the following wave period bands (or increments of period):

27-100 sec (average of 48 data points)

100-196 sec (average of 10 data points)

217-461 sec (average of 6 data points)

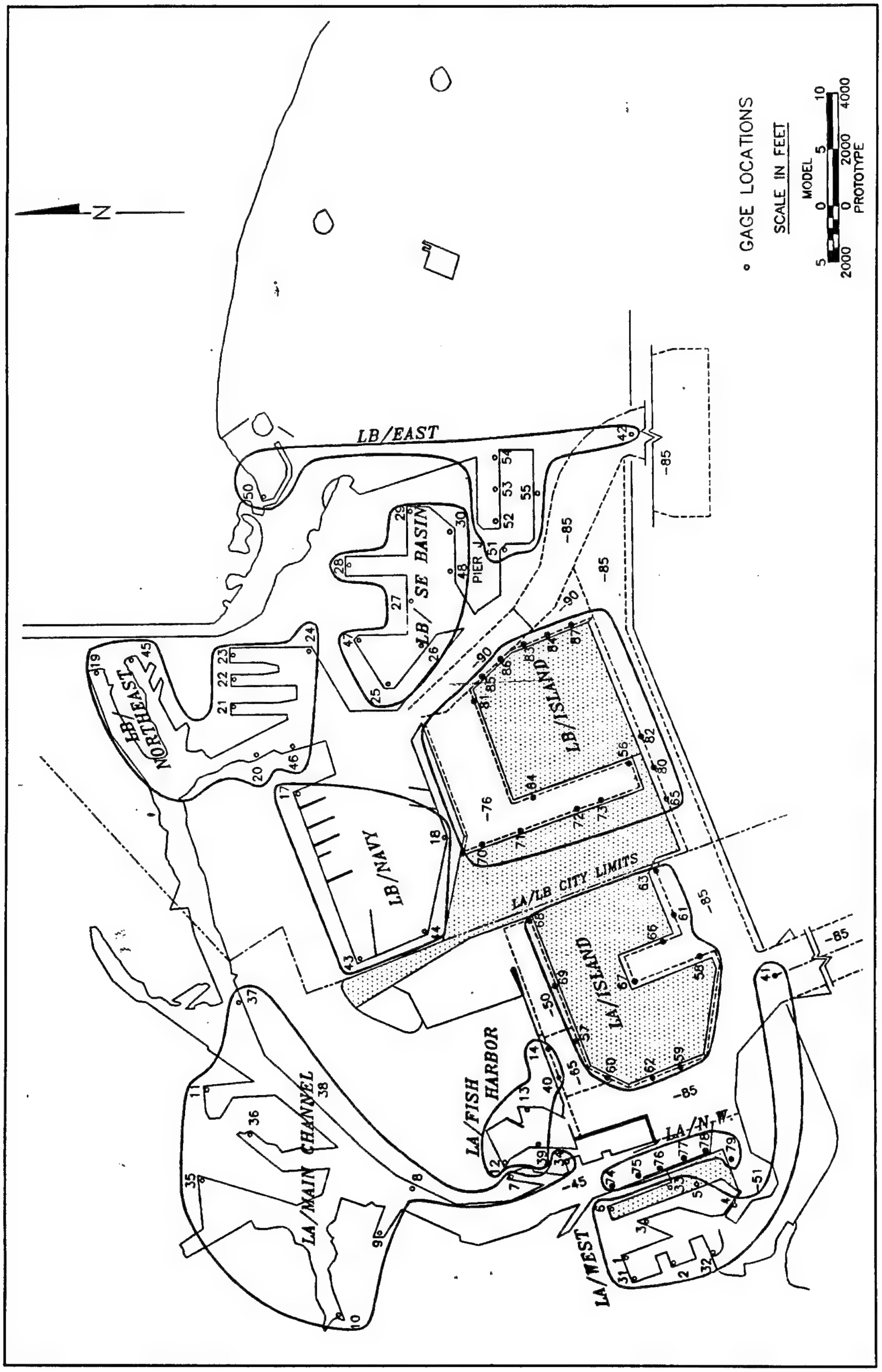


Figure 10. Wave gauge clusters shown on Phase II, Scheme B Plan

Figure 11 shows three plots covering the three period increments indicated, for the LB east cluster of wave gauges. Data for three harbor configurations are compared, including base, Phase I, and Phase II. This smoothing or averaging of data provided a faster way to determine trends in data. However, individual gauge data plots should be examined to determine peak values of wave height amplifications for specific wave periods or period bands (presented in Appendices A, B, C, and D).

## LA Main Channel Gauge Cluster

Average wave amplifications were generally reduced in the Los Angeles Main Channel for Phases I and II. Plates 1-9 show wave height amplification averages for the three test spectra for three period ranges of 27-100 sec, 100-196 sec, and 217-461 sec. The averages for 10 gauges are presented on each plot, with gauge order on the plot proceeding north into the inner harbor (see Figures 7, 8, and 10 for gauge locations).

Examination of Plates 1-3 indicates that neither Phase I nor Phase II caused any significant problem for the 27- to 100-sec range, especially since all amplifications for the plans are close to one or less. Gauges 9 (passenger ship terminal, Slip 93), 10 (Berth 109), and 36 (Slip 1) showed significant reduction in this range. Gauges 34 (dry dock facility), 7 (Berth 240C), and 8 (Berth 230, on Main Channel) had slight average increases.

For 100-196 sec (Plates 4-6), wave height amplifications were reduced for Phases I and II except for a slight increase at gauge 8, which was still below or near a wave height amplification value of 1.0. More energetic gauges 34, 9 (passenger ship terminal), and 36 showed reductions, except average values were still relatively high at gauge 9 (down to 2- 2.5 for Phase II from a base condition value of 4.5).

For 217-461 sec (Plates 7-9), amplification for Phases I and II were reduced significantly at gauges 9, 10, and 36, while gauge 7 stayed relatively close to base condition averages, ranging from wave height amplifications of 2.5 to 4.8. Values for other gauges in this cluster were close to or below base conditions in this period range.

Overall, Main Channel wave height amplifications were reduced the same magnitude for Phases I and II.

## LA West Wave Gauge Cluster

Gauges in this group are located in Los Angeles Harbor's East and West Basins with the exception of gauge 41 at Angel's Gate. It should be noted that for Phase II, no data are available at gauge locations 5, 6, and 33, since the East Channel is filled in. Data are plotted on Plates 10-18. For the 27- to

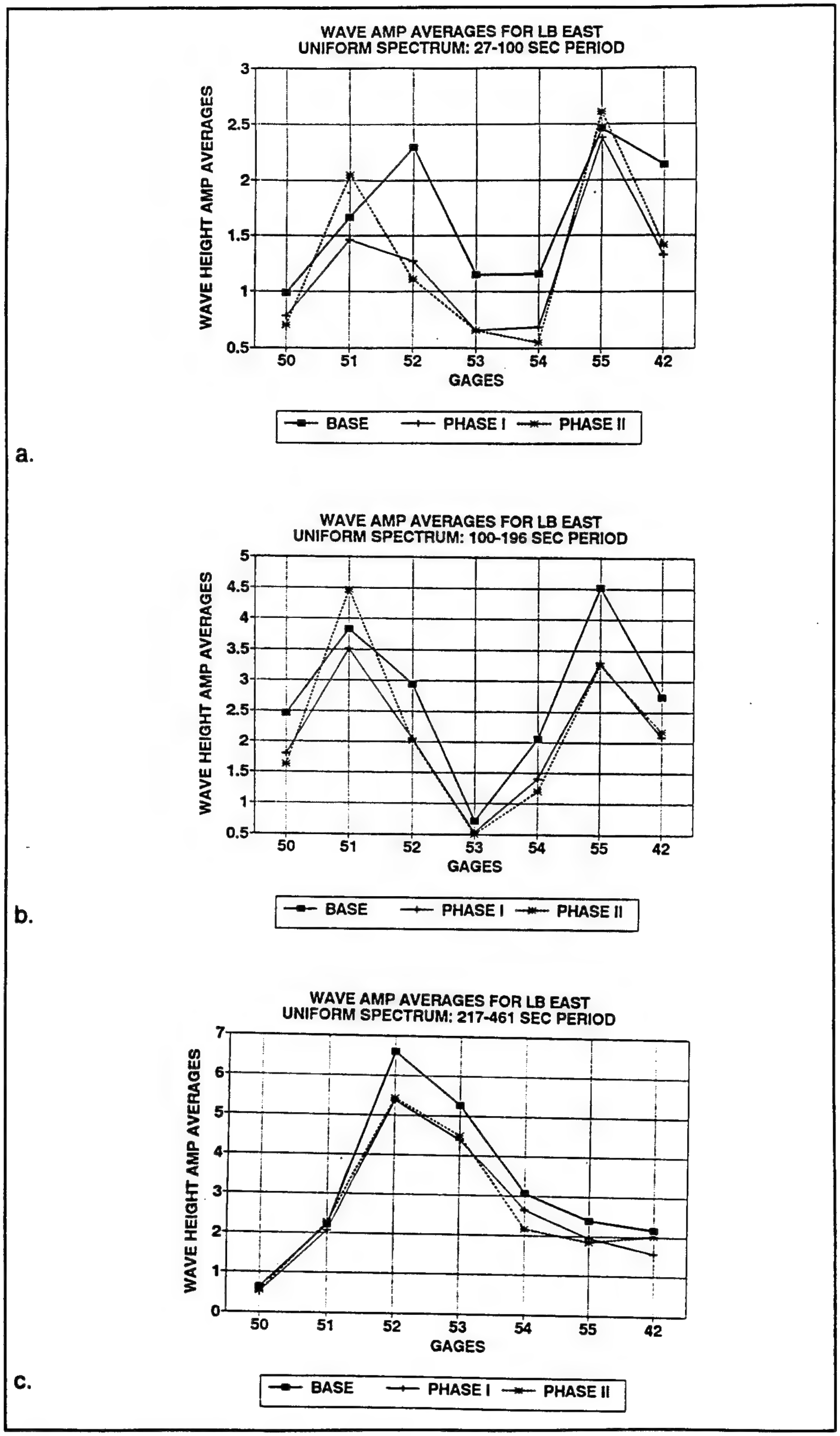


Figure 11. Results for LB wave gauge cluster

100-sec period range, Phase I (Plates 11 and 12) caused slight increases at higher energy location gauges 3 (Watchorn Basin), 32 (Cabrillo Basin), 5 (Coal Terminal), and 6 (East Channel). For the February spectra, Gauges 3 and 32 increased for Phase II with amplification of 3. These gauges are diagonally across from one another and are evidently cross-coupled for the February spectrum.

For the 100- to 196-sec range, wave height amplifications (Plates 13-15) were generally reduced for Phases I and II, except for the February spectrum again, where gauges 3 and 32 appeared cross-coupled, and showed an increase over existing conditions. It should be noted that gauges 3, 32, 5, 6, and 33 (East Channel Berth 52) have notable (however, not extreme) wave height amplifications in this period range.

In the 217- to 461-sec range (Plates 16-18), there were slight increases in wave height amplification at gauges 31, 3, and 32, with the February spectrum again pointing out a strong cross-coupling of gauges 3 and 32. Gauge 6 in East Basin showed that Phase I reduced average wave amplification by approximately 1.0 for each spectrum; however, maximum amplifications were 8-10, which is a troublesome range.

Overall, compared to base conditions, there were notable increases in wave height amplifications at some gauge locations for the 27-to 100-sec period range in West Channel, mostly decreases in values in the 100- to 196-sec range, and not much difference in the 200- to 461-sec range (except for the Watchorn Basin-Cabrillo Basin response for the February spectra). Phase II response was generally close to or less than Phase I except at gauges 3 and 32.

## LA Fish Harbor Gauge Cluster

Plates 19-27 show that for all period ranges, wave height amplifications were reduced for Fish Harbor and for gauges 40 and 14, berth locations along Pier 300.

The most significant reduction was for gauges 40 and 14. In the 100- to 196-sec range, average wave height amplifications dropped from values between 2 and 2.5, to values less than 0.7. In the longer wave period range of 217 to 461 sec, values dropped from a 1.7- to 3.2-sec range, to a 1.3- to 0.6-sec range.

Overall, reductions occurred for the gauges in Fish Harbor and the two gauges at Pier 300 for the entire range of wave periods. Phase II response was usually slightly less than Phase I except at gauge 40.

## LB Navy Basin Gauge Cluster

Plates 28-30 indicate that average wave height amplifications for Phases I and II in the Navy Basin were relatively low (usually less than 1.0) in the 27- to 100-sec period range and in most cases were lower than base conditions, except for gauge 17 (NE Navy Basin, January spectrum, Plate 29, 1.8 wave height amplification) and for gauges 17 and 44 (Navy Basin Mole) with the February spectrum.

In the 100- to 196-sec wave period range (Plates 31-33), reductions at all gauges from the base condition were seen for the uniform spectrum (Plate 31), while Phase I showed little change from base conditions for the January and February spectra, and Phase II showed definite decreases for average wave height amplifications, with values of about 1.5 and less.

In the 217- to 461-sec wave period range (Plates 34-36), there were decreases at gauge 18 for each spectrum, while changes of up to plus 2.0 occurred, with average amplifications increasing at gauges 43 and 44 for the January and February spectra.

In the lower period groups of 27-100 and 100-196 sec, Phase II wave height amplifications were less than Phase I, and Phase I was generally less than base conditions. However, in the 217- to 461-sec period range, amplifications were greater than base except at gauge 18.

## LB Northeast Gauge Cluster

Wave height amplification was low for the 27- to 100-sec range of wave periods seen in Plates 37-39, with average values of wave height amplification always below 0.8. Also, gauge 24 (Pier A) had some increase in peaks in the 30- to 40-sec range (plate D13), with amplification values increasing from 1 to 2.

In the 100- to 196-sec range, the uniform spectrum showed significant decreases at all gauges (Plate 40). For January and February spectra, there were increases at gauges 20, 21, and 45 for Phase I, but these changed to near or below base for Phase II, with relatively low values of wave height amplification (Plates 41 and 42).

For the 217- to 461-sec period range, there were some increases, primarily for the January and February spectra, Phase II tests (Plates 43-45). Gauges 21, 22, and 23 were the most significantly affected for these longer periods.

Phase II wave height amplifications were typically lower than Phase I in the 27- to 100-sec and 100- to 196-sec period range, but increased for the 217- to 461-sec range relative to Phase I (and base conditions) at gauges 21-24 (Slips 3, 2, 1, and Pier A, respectively).

## LB Southeast Gauge Cluster

Southeast Basin response for the 27- to 100-sec wave period range indicated increases of average wave height amplifications at most locations (Plates 46-48); however, values are relatively low, except at gauge 27 (Berth 226), with an average value of 1.8 (January spectrum, Plate 47). Phase I changes were greater than those of Phase II except at gauge 25 (Banana Terminal).

For the 100- to 196-sec wave period (Plates 49-51), there was a definite trend for increase in wave height amplification with Phase I; then an overall reduction with respect to base conditions due to Phase II.

For longer wave periods of 217-461 sec (Plates 52-54), there was a trend toward increases at all gauges, with Phase II showing the greatest increase. Amplification factors were relatively high at gauge 28 (Berth 231), with an average wave height amplification of about 4.8 for the January spectrum.

## LB East Wave Gauge Cluster

Most of these gauges are in the newest Pier J expansion area. For the 27- to 100-sec wave period range there were mostly decreases in average wave height amplification except at the outer harbor gauges 51 and 55 (Plates 55-57). Phase II showed the greatest decrease.

For the 100- to 196-sec wave period range, there were slight decreases in average wave height amplification, except for a slight increase at gauge 51 (Plates 58-60). Phase II had a slightly greater decrease than Phase I, except at gauge 51.

In the 217- to 461-sec wave period range, there were mostly decreases in these very high response regions, except for the February spectrum, which indicated a slight increase for Phase I at gauges 52-54 (Plates 61-63). Gauge 52 had an average wave height amplification of up to 8.0. Phase II had a greater overall decrease for this period range.

## LA Island Wave Gauge Cluster

These gauges extend in a counterclockwise direction around the edge of the Los Angeles portion of the proposed landfill, starting at the eastern end of the northern channel. These are new gauge locations; therefore, there are no base data for comparison. Plates 64-66 indicate relative low wave height amplifications for the 25- to 98-sec period range, with maximum average values of 1.4 occurring at gauge 59, on the western face of the landfill at the more

oceanward location for Phase I. The value decreased to 1.05 for Phase II, quite possibly due to the filling in of the East Channel region, which is opposite this landfill face.

Maximum average wave height amplifications for the 100- to 199-sec period range occur at gauges 67 and 63, with values of 1.15 and 1.60, respectively (Figures 67-69). These gauge locations are on the southern face of the landfill, and there was no significant difference between Phase I and II data.

For the 217- to 461-sec period range (Plates 70-72), gauge 67, in the south channel, had the largest average response with a value of 3.1 (January Spectrum) for Phase I. There was a slight decrease for Phase II at this location. Gauge 66 also had a moderate response, with an average value of 2.2. Gauge 68 had a moderate response, averaging 2.0 for Phase II.

Since these are new berth locations, individual gauge data should be consulted to check for the response over smaller increments of wave periods. Averaging may not emphasize possible troublesome regions of the long wave spectrum at a new location where there is no historical experience for moored ship movement. Inspection of the data in the appendices indicated the only location to consistently indicate some moderate peaks was gauge 67 in the corner of the southern slip of the landfill. Criteria were based on wave height amplification greater than four for all four data sets in the appendices. Gauge 67 had these peaks (between 4 and 7) in the 250-300 sec range, typically not in the range causing moored ship motion at the wave height amplification level noted in the data. The greater depths of Phase II reduced these peaks by 20-30 percent.

## LB Island Wave Gauge Cluster

The Long Beach portion of the island landfill is covered by seven gauges for Phase I and fifteen gauges for Phase II. Gauge data are plotted in order, starting at the southwesternmost location and proceeding counterclockwise. Wave amplification averages for the 25- to 98-sec period range (Plates 73-75) indicated fairly low values, with a 1.2 maximum at gauge 83.

The 100- to 199-sec period range showed a slight increase over the lower period band with a maximum average value of 1.7 at gauge 80, on the southern face, followed by a 1.55 value at gauge 56, in the corner of the interior channel (Plates 76-78).

For the 217- to 461-sec period range (Plates 79-81), there was a gradual increase (from gauges 67-85) on the east side of the landfill until a maximum of 3.0 is reached at gauge 85 (January spectrum, Plate 80). The highest average value occurred at gauge 56 for the Phase II condition with a value of wave height amplification of 4.8.

Examination of the individual plots in the appendices for peak wave height amplifications at the LB Island gauges was performed as discussed above for LA Island. Gauges 56, 72, 73, and 86 exceeded the criteria of wave height amplification of 4.0 for a given period, for all test conditions. Gauge 86, opposite the entrance to Southeast Basin, barely exceeded the criteria at the 270-sec period. Gauges 56, 72, and 73 had maximum wave height amplifications from 4 to 12, depending on test conditions and construction phase for the period range of 300-400 sec. The response somewhat follows that of the East Basin in Los Angeles Harbor (gauge 6) which has had some berthing problem areas at its northernmost end. Wave height amplification magnitude at gauge 56 is at a lower magnitude than that of gauge 6. Some modification of the landfill might be required to reduce amplifications.

## LA New Wave Gauge Cluster

This group of wave gauges follows northward along the western edge of Main Channel at berth locations created by filling East Channel. Plates 82-84 indicate fairly low average wave amplification values for the 25- to 98-sec period range.

Plates 85-87 indicate that wave height amplifications at gauge 77 were about double those at the other locations in the 100- to 199-sec period range, with an average value of 2.2. Individual maximum peak values of up to 6.5 occurred at gauge 77 for the 110-sec period.

For the 217- to 461-sec wave period group (Plates 79-81), wave height amplification values were relatively low, with a maximum average value of 1.65 at gauge 75.

# 5 Summary and Conclusions

Physical model tests of the OFI Scheme B, Phases I and II, 2020 Plan were performed and wave height amplification data were compared to base (or existing) conditions.

An analysis based on grouping wave height amplifications for the harbor basins into three period ranges of 27-100 sec, 100-196 sec, and 217-461 sec was used for easy comparison of test results. Wave height amplification data were collected for three long-wave spectra, including the 17 January 1988 Martin Luther King Day storm, the 2 February 1986 storm, and a spectrum representing average long wave conditions with a southerly approach to the harbors. Detailed wave spectra for all gauge location measurements were included as appendices.

Based on results from the physical model for Los Angeles Harbor with the 2020 Plan in place, the following conclusions are reached:

*a.* For locations along Main Channel, Phases I and II reduced wave height amplifications relative to existing conditions except at gauge 7, slip 240, where a slight increase was noted in the 217- to 461-sec period range.

*b.* For locations in West Channel, Cabrillo Basin showed an increased response for storm spectra but not for the average southerly wave spectrum. Watchorn Basin also responded in a similar manner and shared similar period peaks indicating cross-coupling of these two basins.

*c.* For locations in East Channel, some slight increases in wave height amplification were noted for the 27- to 100-sec period range. For the more energetic 217- to 461-sec range, decreases of about 25 percent from existing conditions were measured. These were for Phase I conditions. The basin was filled in for Phase II tests.

*d.* Fish Harbor showed significant reduction in wave height amplification for all period ranges for Phases I and II.

*e.* Wave gauges 14 and 40, which are located at the new dry bulk and container terminals of Scheme B at Pier 300, indicated a significant

reduction of wave height amplification from existing conditions for all wave conditions, over all period ranges due to the construction of the project in the outer harbor.

*f.* Wave height amplification data collected at proposed new berths along the island landfill and along Pier 300 were low in the 25- to 98-sec wave period range with average amplification values less than 1.4. Gauge 63 in the southeast corner of the LA Island landfill region had a moderate response in the 100- to 199-sec period range with average amplification values no greater than 2.0. Gauge 67 in the southern slip facing the south had the greatest response which occurred for the 217- to 461-sec wave period range and average wave height amplification values were 3.2 or less. Individual peaks of wave height amplification within the 217- to 461-sec range were between 4.0 and 7.0 for the four test conditions. The Phase II condition lowered these peaks.

*g.* For Phase II's new berths on the west side of the entrance to Main Channel, wave height amplifications were low in the 25- to 98-sec range, increasing for the 100- to 199-sec range (maximum wave amplification of 2.6) and reduced to a maximum of 1.7 for the 217- to 461-sec period range.

Based on results from the physical model, it is concluded for Long Beach Harbor that:

*h.* Long Beach West Basin (Navy Basin) has reduction in wave height amplification for almost all gauges in the lower two wave period groups when compared to existing conditions, but had increases over base up to 50 percent above existing conditions in the 217- to 461-sec period group. This increase was strongest on the north side of the basin.

*i.* Wave height amplification in the northeast portion of Long Beach Harbor was relatively small in the 27- to 100-sec period range (average amplifications less than 1.0). In the 100- to 196-sec range, only the storm spectra for Phase I produced an increase in average wave height amplifications, and at only two of the eight measured locations. For the 217- to 461-sec period range, there were some increases at finger slip Piers B, C, and D for Phase II conditions, with maximums of 5.0 at Pier D.

*j.* The Southeast Basin responded similar to existing conditions for the 27- to 100-sec and 100- to 196-sec period ranges except for gauge 27 (Berth 226) which had a significantly higher response (maximum of 2.2 wave height amplification) only for the January spectrum. For the 217- to 461-sec period range, there was a uniform increase over existing conditions for average amplification, with the maximum response at Pier G (maximum average amplification of 4.8 for the January spectrum).

*k*. There were no significant changes from existing conditions in wave height amplification at gauges on the east side of Long Beach Harbor at Pier J.

*l*. For the Long Beach Island landfill, wave response was very moderate in the 25- to 98-sec wave period range (maximum average wave height amplification of 1.2) and slightly higher in the 100- to 199-sec wave period range (maximum average amplifications of 1.8). For the 217- to 461-sec wave period range, there were moderate wave height amplifications at most locations on the outside edges (mostly Phase II berths) with maximums at gauge 85 (average amplification of 3.0) facing Southeast Basin. In the interior channel of the new landfill at gauge 56, maximum average amplifications reached a value of 5.0. Gauge 56 individual wave height amplification values for Phase II reached as high as 12 at long wave periods of about 370 sec. This was for waves from the south. Amplifications between six and eight occurred for waves from the west. Typically these longer wave periods have less effect on moored ship response. Phase I amplification values were lower at gauge 56.

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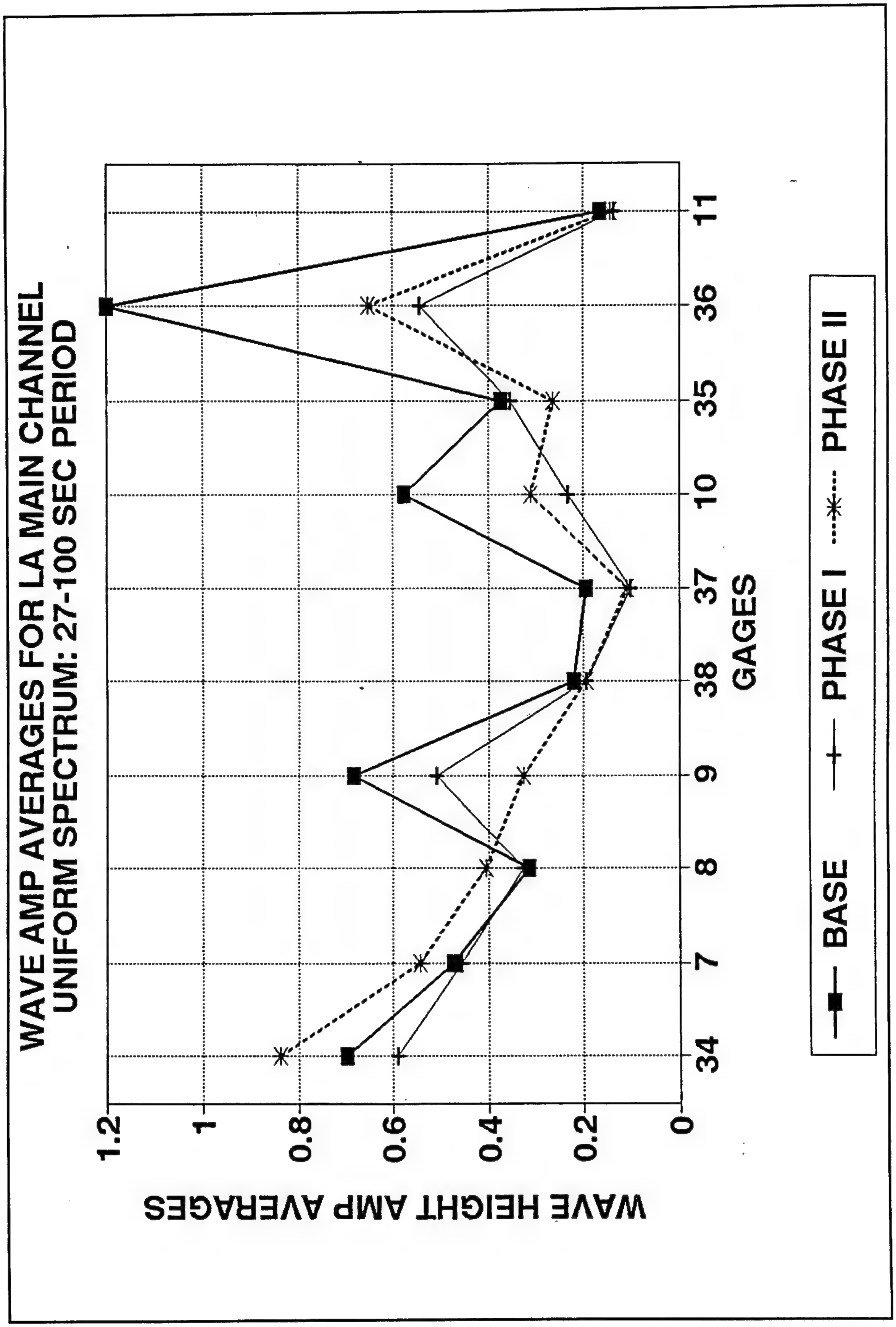
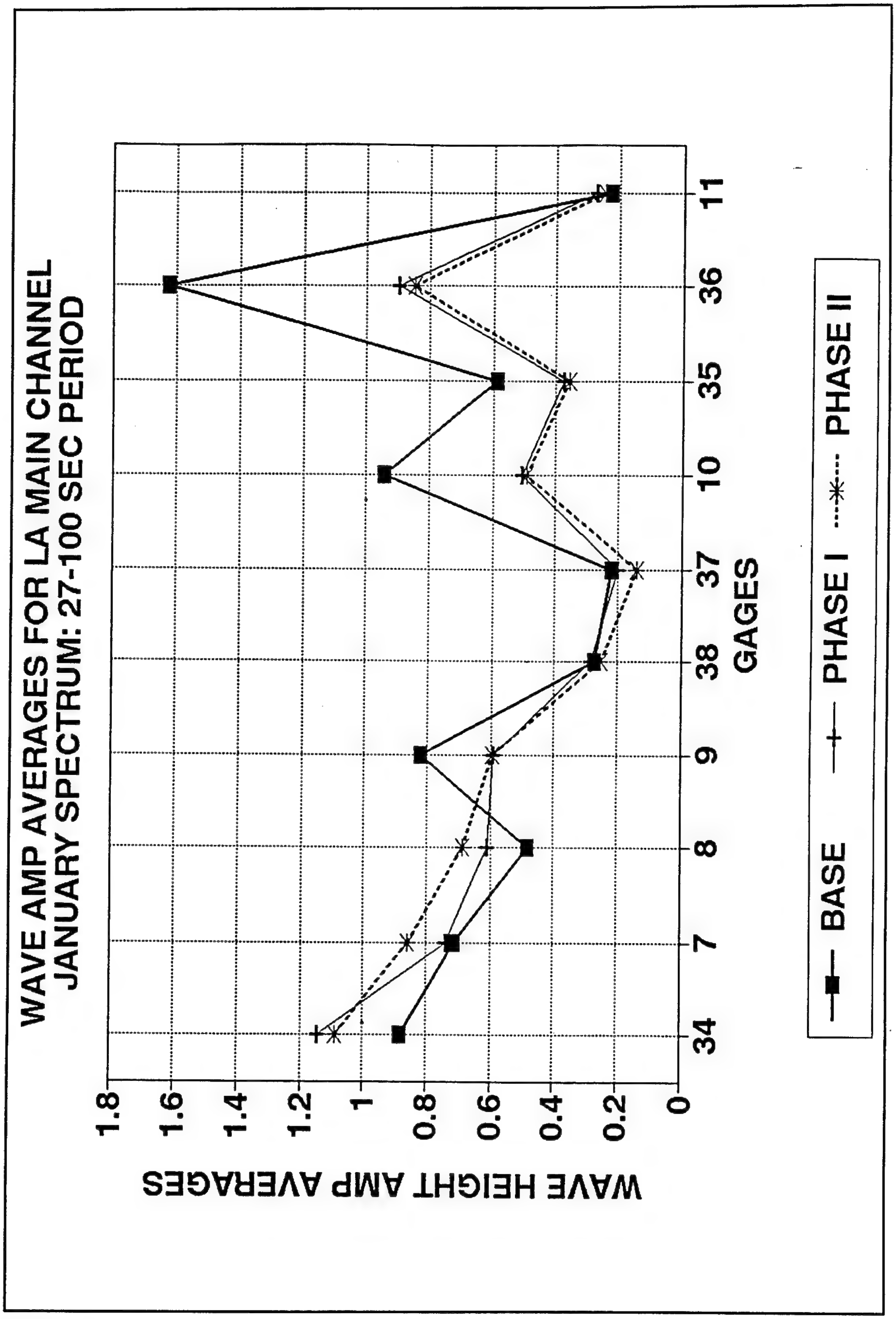
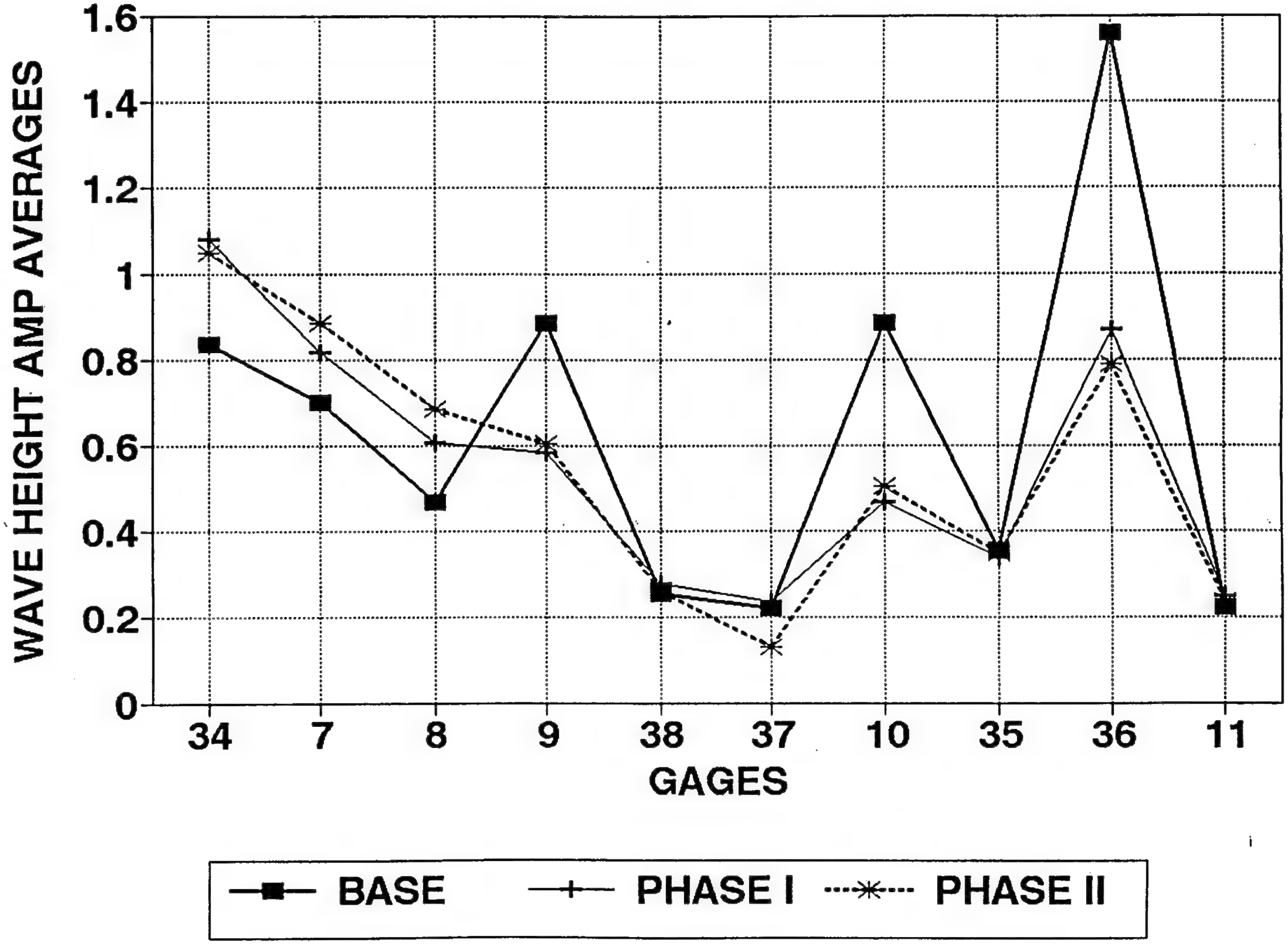

WAVE AMP AVERAGES FOR LA MAIN CHANNEL
UNIFORM SPECTRUM: 27-100 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
1.2
1
0.8
0.6
0.4
0.2
0
34
7
8
9
38
37
10
35
36
11
GAGES
BASE
PHASE I
PHASE II



WAVE AMP AVERAGES FOR LA MAIN CHANNEL
JANUARY SPECTRUM: 27-100 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
34
7
8
9
38
37
10
35
36
11
GAGES
BASE
PHASE I
PHASE II


Plate 2

WAVE AMP AVERAGES FOR LA MAIN CHANNEL
FEBRUARY SPECTRUM: 27-100 SEC PERIOD



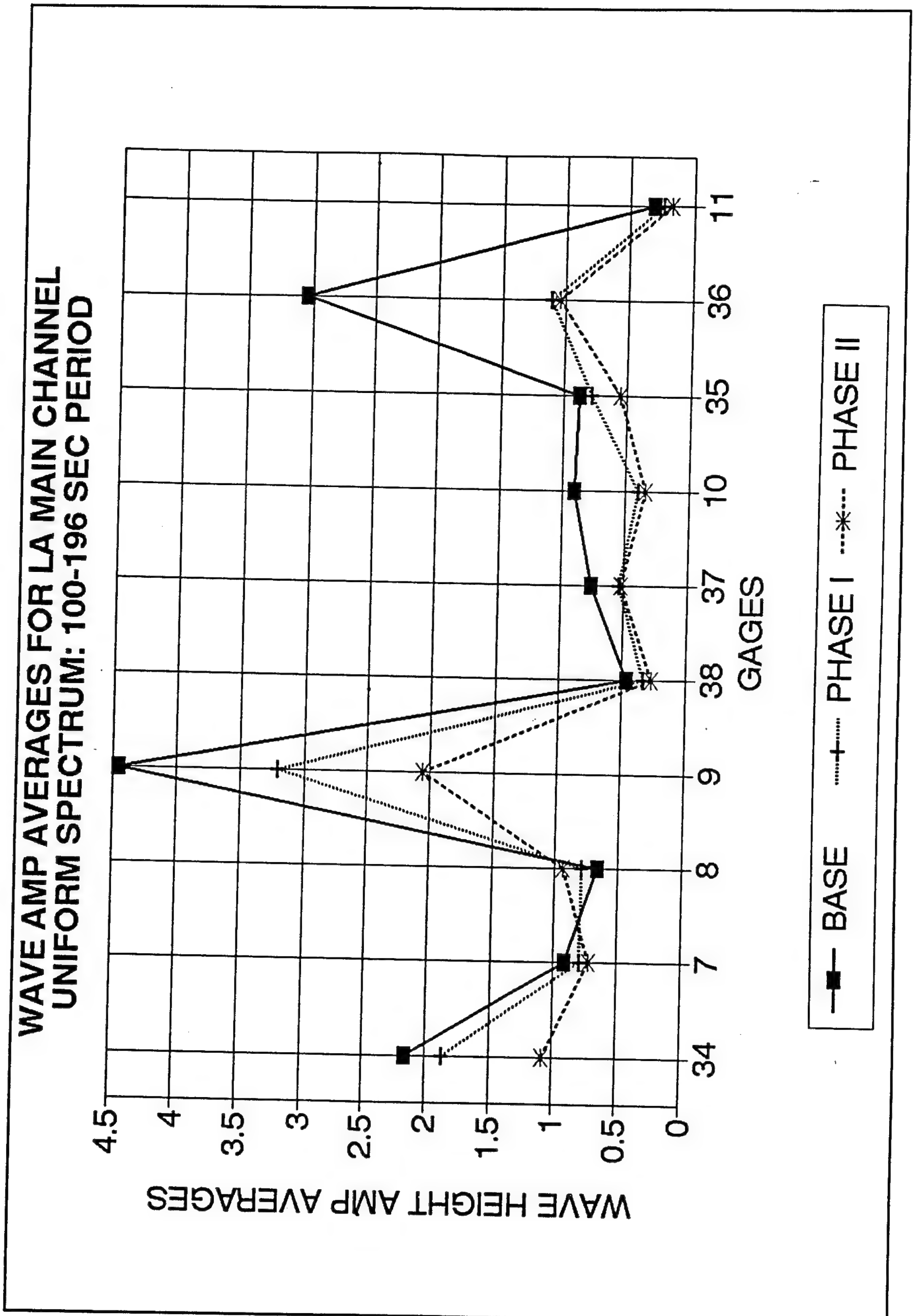

WAVE AMP AVERAGES FOR LA MAIN CHANNEL
UNIFORM SPECTRUM: 100-196 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
34
7
8
9
38
37
10
35
36
11
GAGES
BASE
PHASE I
PHASE II

Plate 4

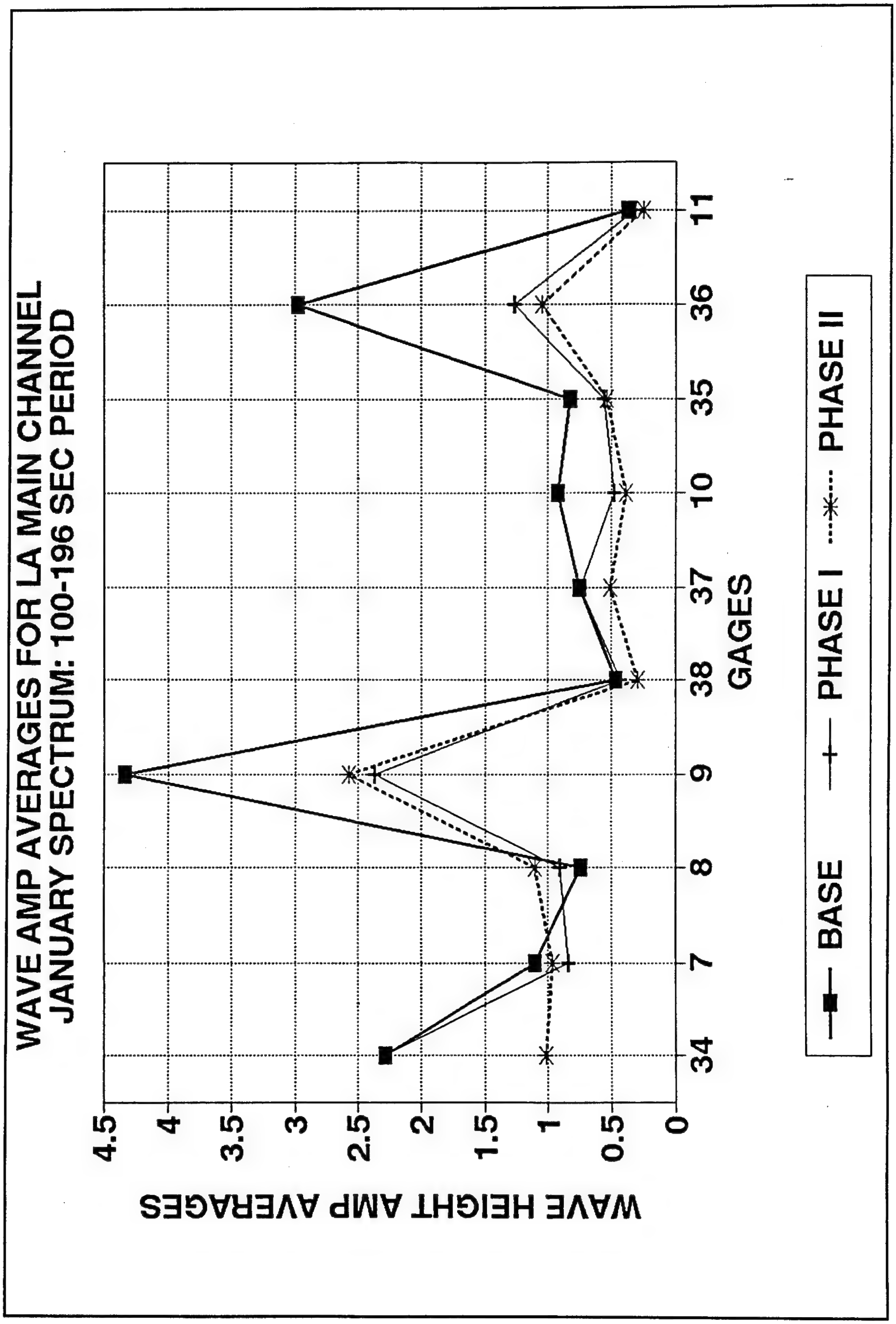
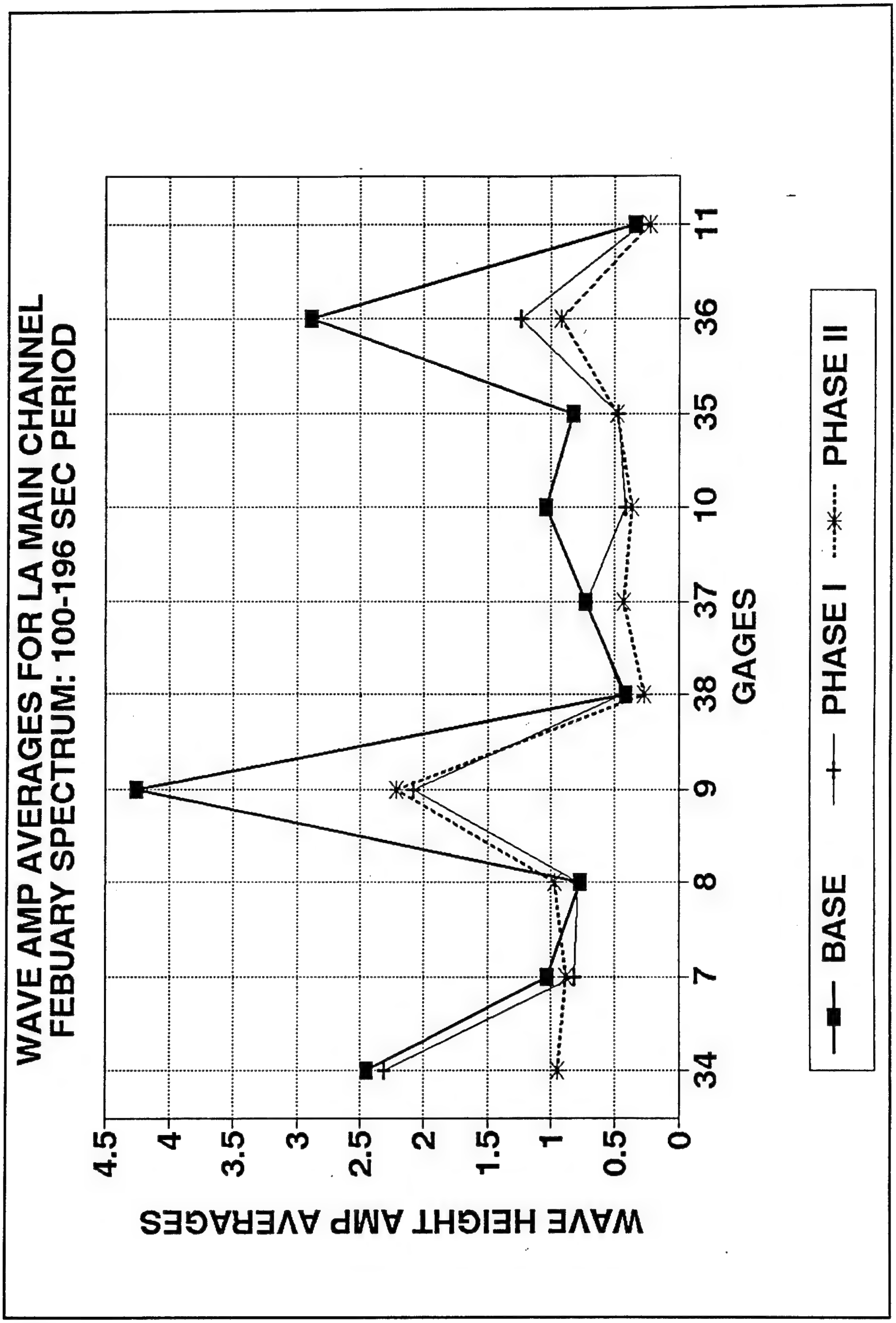

WAVE AMP AVERAGES FOR LA MAIN CHANNEL
JANUARY SPECTRUM: 100-196 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
34
7
8
9
38
37
10
35
36
11
GAGES
BASE
PHASE I
PHASE II

Plate 5


WAVE AMP AVERAGES FOR LA MAIN CHANNEL
FEBUARY SPECTRUM: 100-196 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
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4
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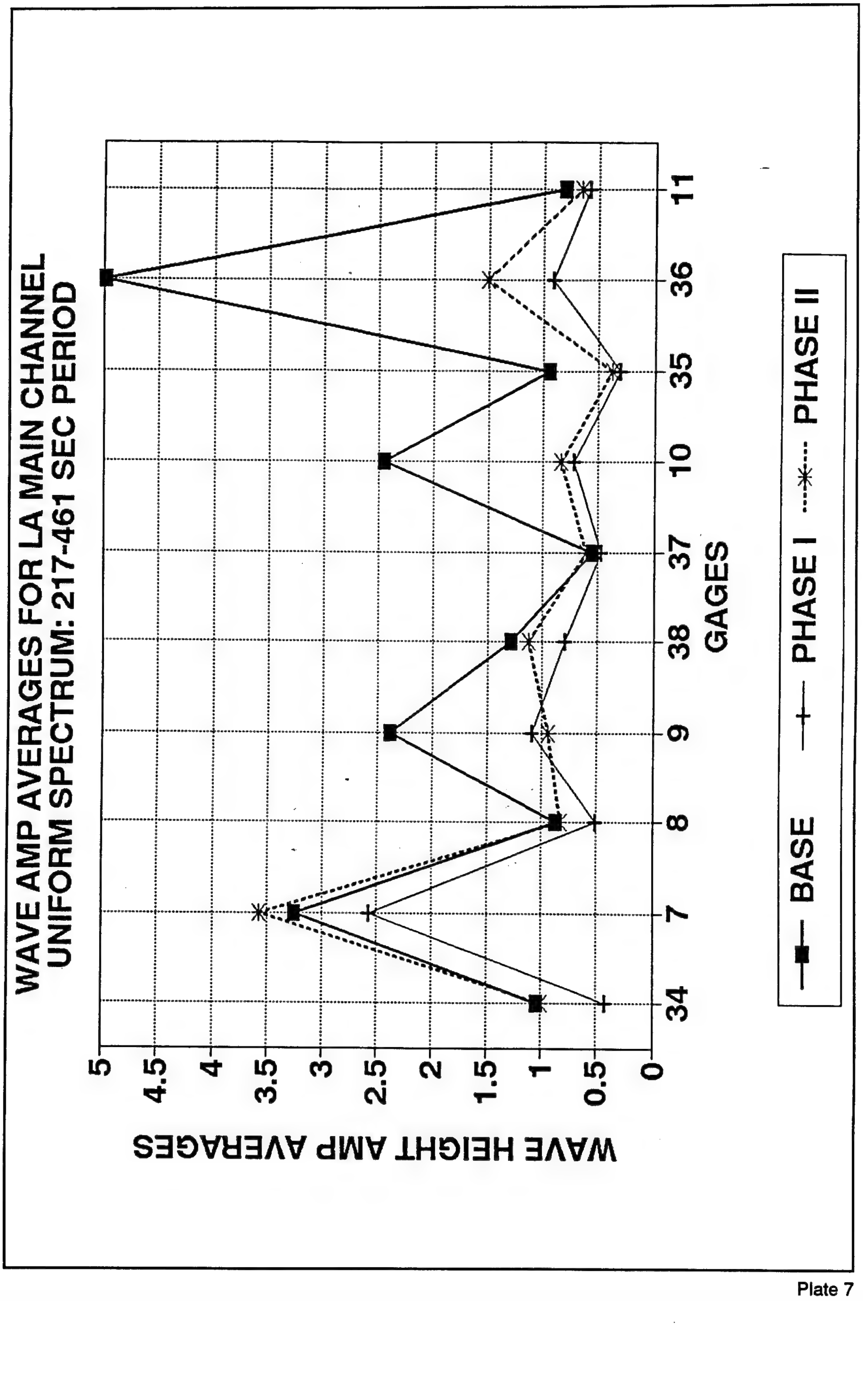
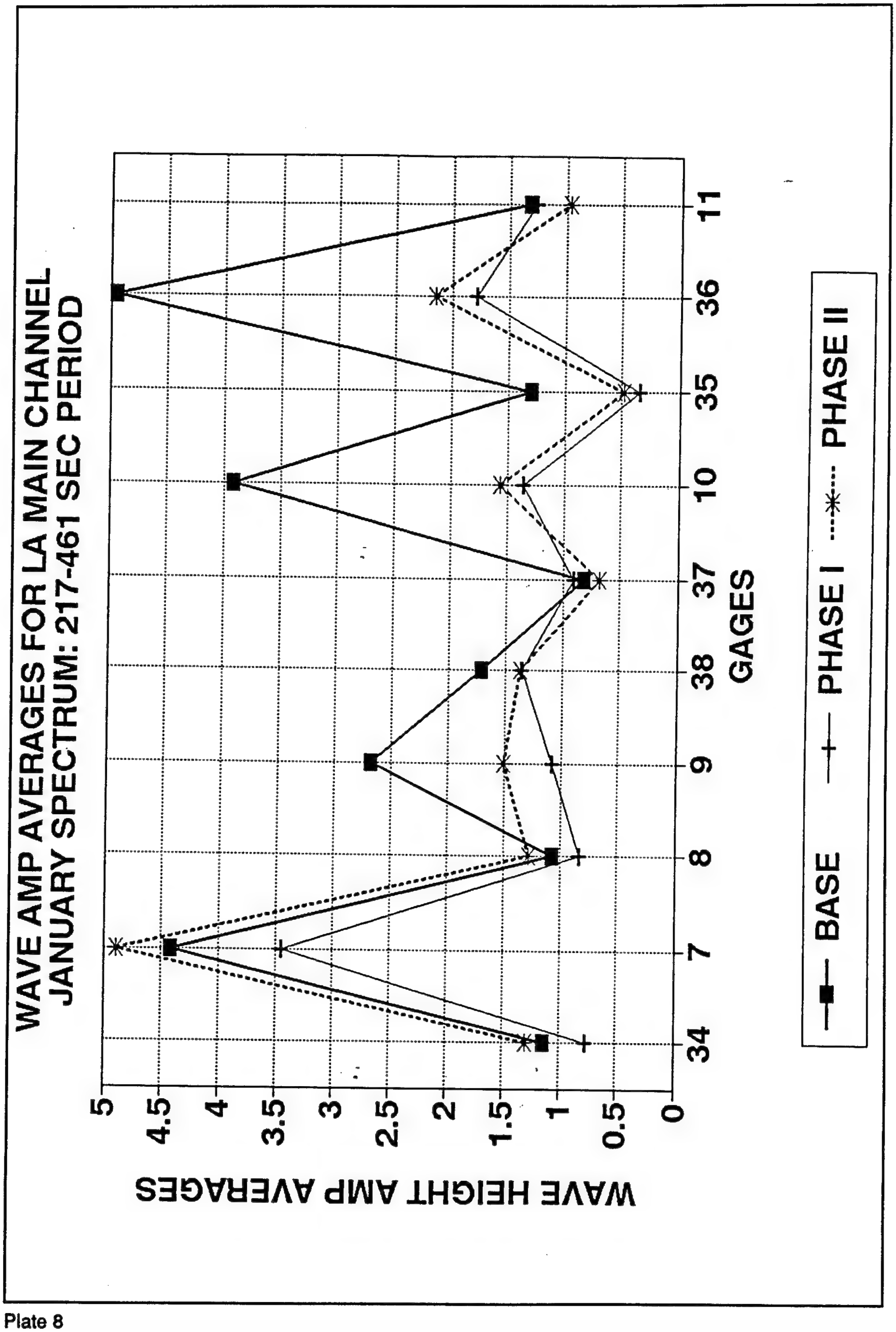
2.5
2
1.5
1
0.5
0
34
7
8
9
38
37
10
35
36
11
GAGES
BASE
PHASE I
PHASE II
Plate 6



WAVE AMP AVERAGES FOR LA MAIN CHANNEL
UNIFORM SPECTRUM: 217-461 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
34
7
8
9
38
37
10
35
36
11
GAGES
BASE
PHASE I
PHASE II


WAVE AMP AVERAGES FOR LA MAIN CHANNEL
JANUARY SPECTRUM: 217-461 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
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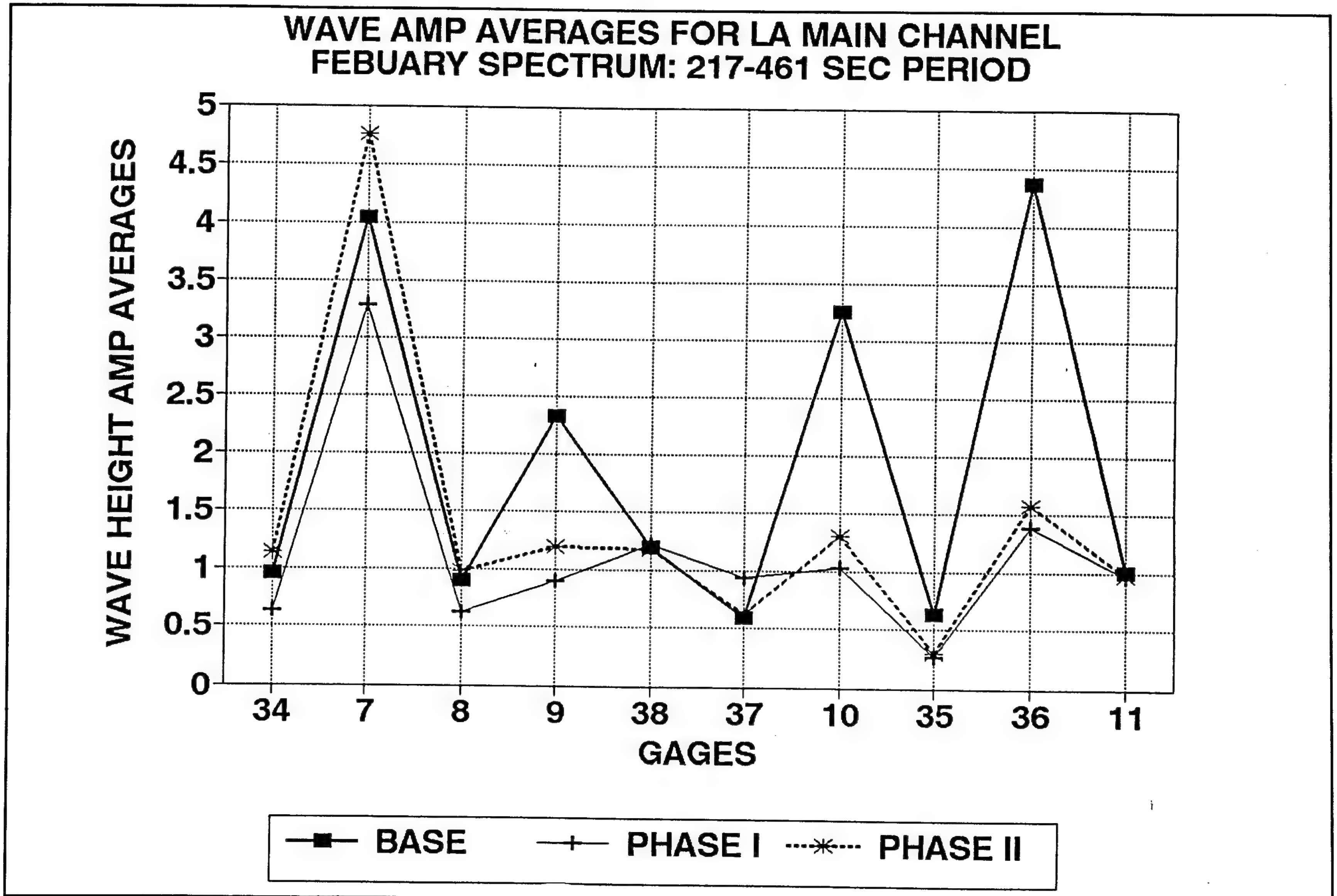
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
34
7
8
9
38
37
10
35
36
11
GAGES
BASE
PHASE I
PHASE II

Plate 8


WAVE AMP AVERAGES FOR LA MAIN CHANNEL
FEBUARY SPECTRUM: 217-461 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
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1
1.5
2
2.5
3
3.5
4
4.5
5
34
7
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37
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36
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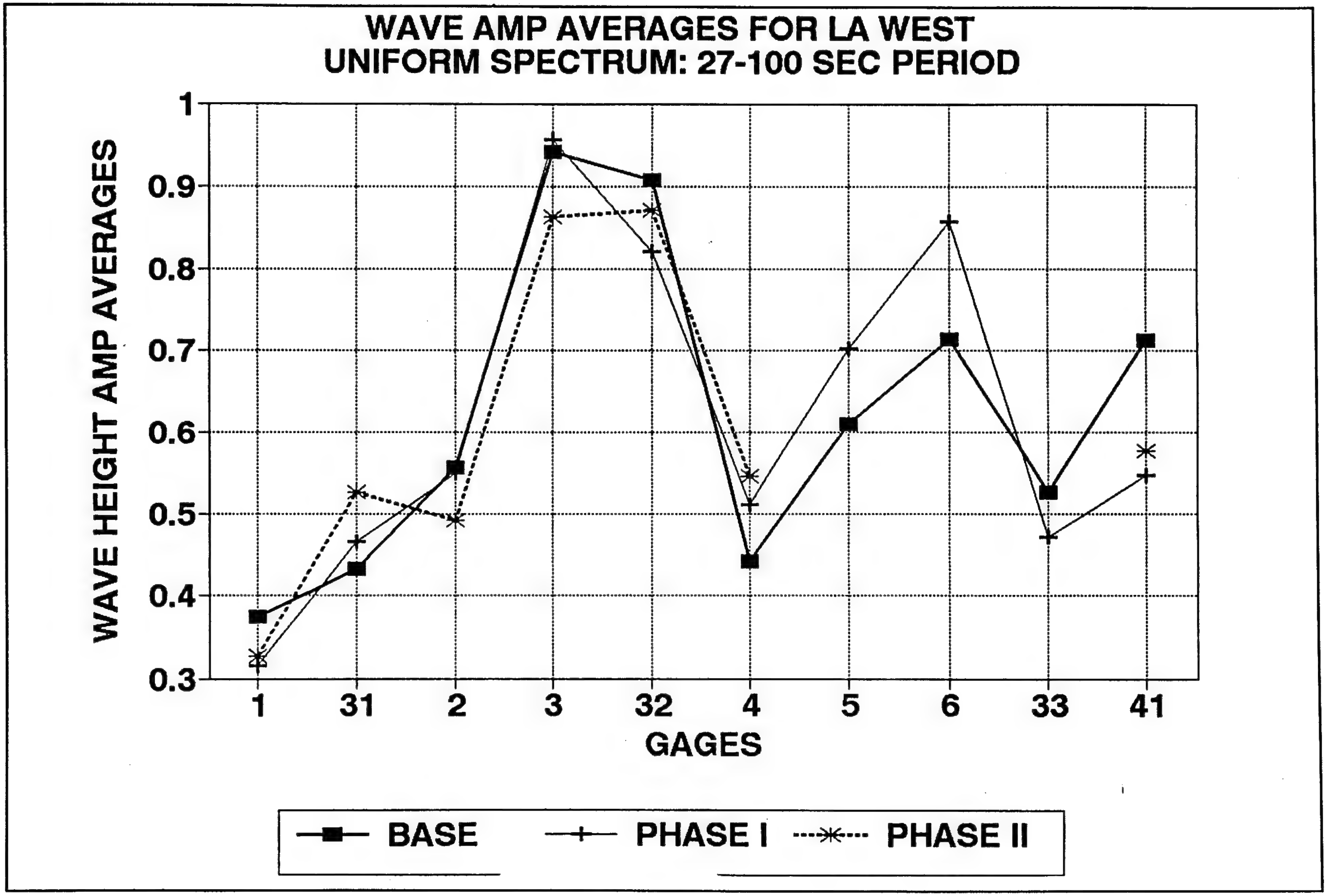
PHASE II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UNIFORM SPECTRUM: 27-100 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
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0.5
0.4
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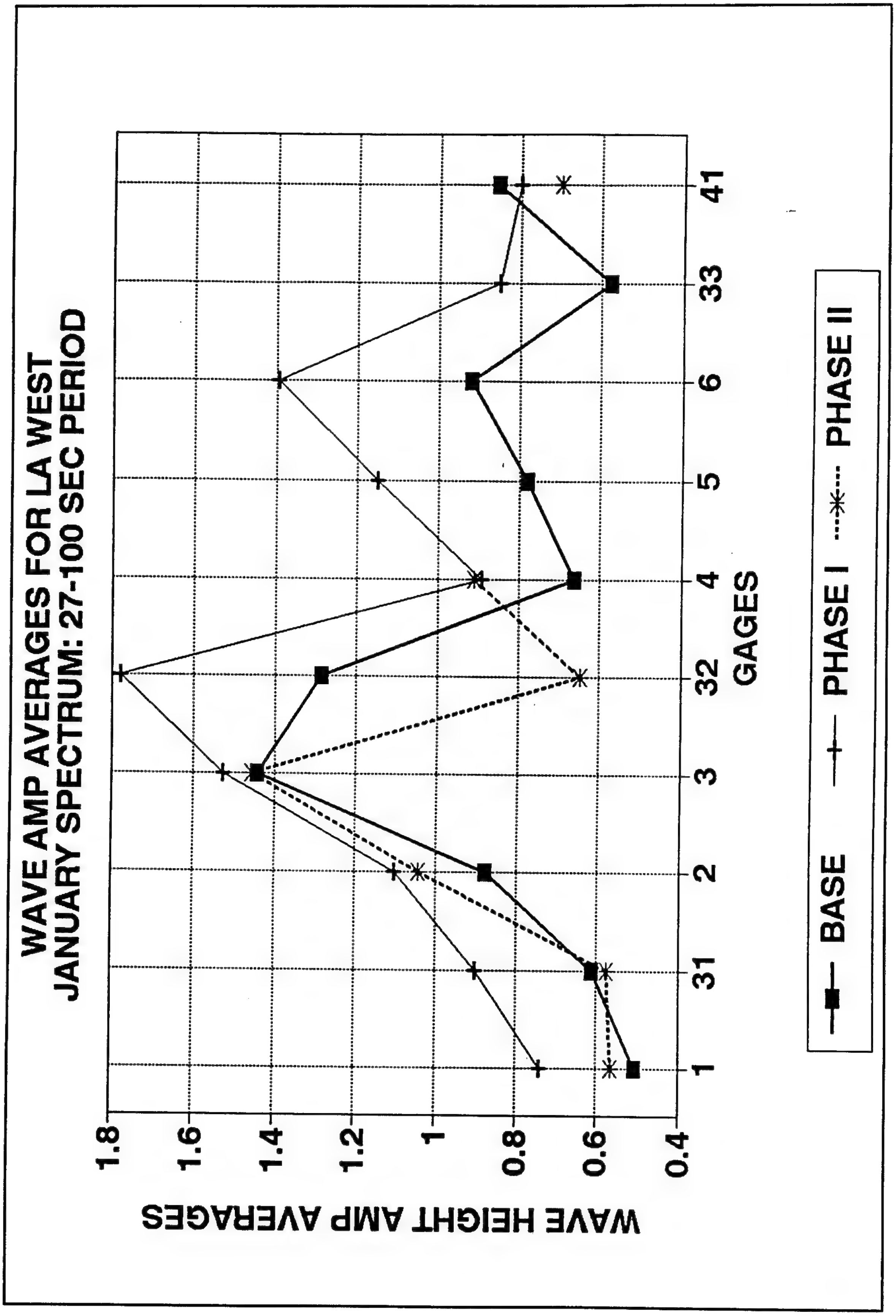
1
31
2
3
32
4
5
6
33
41
GAGES
BASE
PHASE I
PHASE II

Plate 10



WAVE AMP AVERAGES FOR LA WEST
JANUARY SPECTRUM: 27-100 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
GAGES
1
31
2
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6
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41
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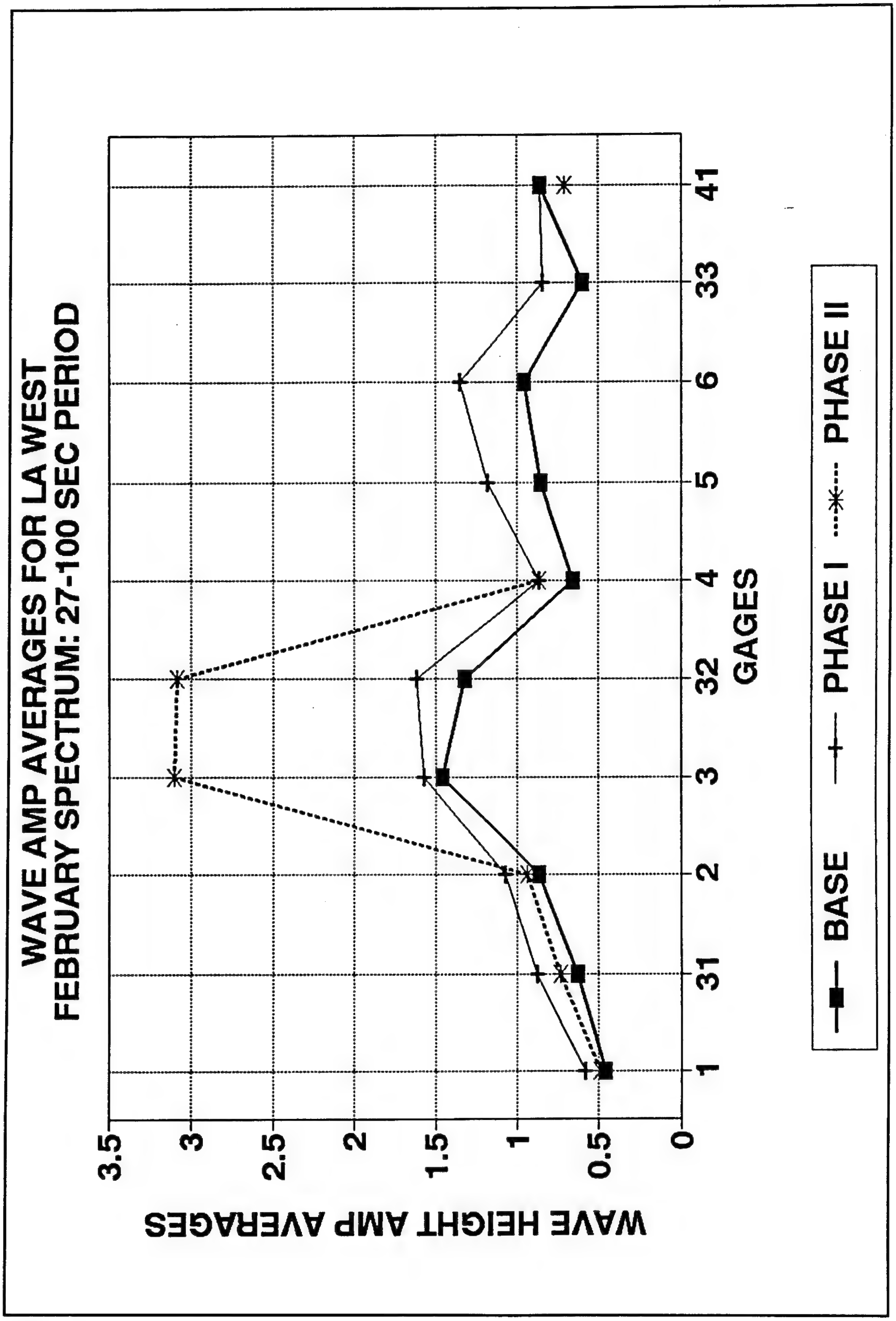
PHASE II



WAVE AMP AVERAGES FOR LA WEST
FEBRUARY SPECTRUM: 27-100 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
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2
2.5
3
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1
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2
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4
5
6
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41
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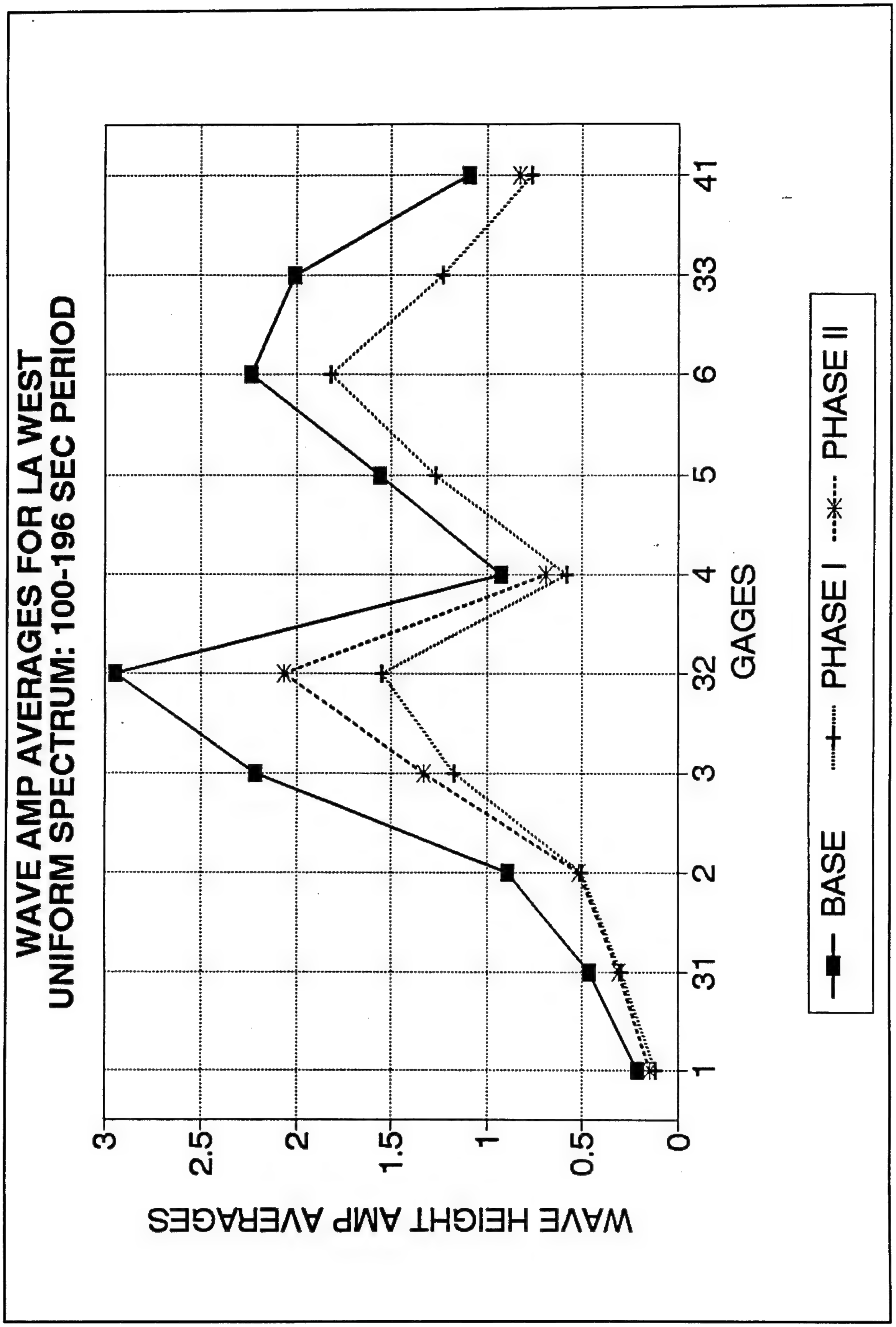
PHASE I
PHASE II


Plate 12


WAVE AMP AVERAGES FOR LA WEST
UNIFORM SPECTRUM: 100-196 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
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1
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2
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3
GAGES
1
31
2
3
32
4
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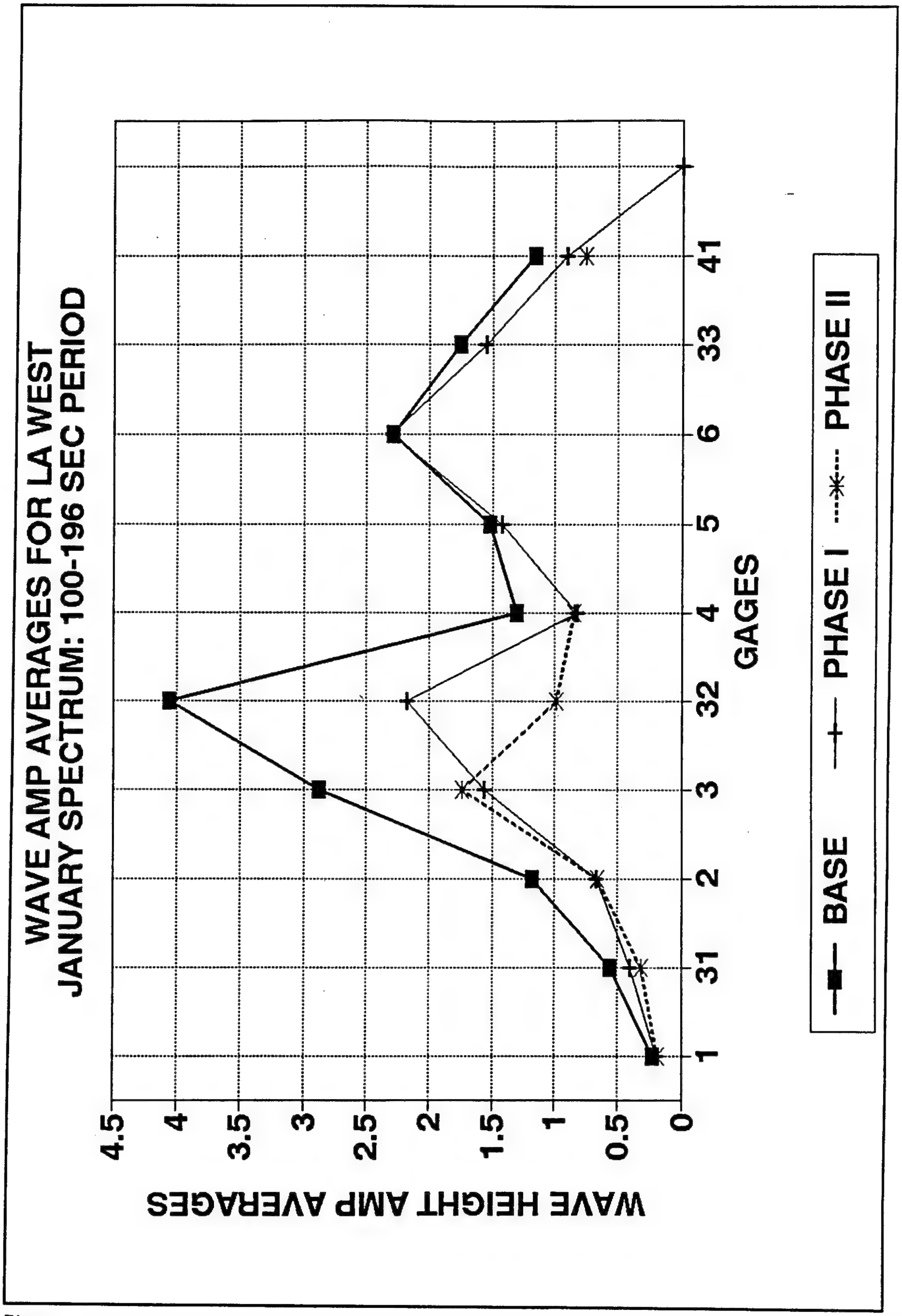
6
33
41
BASE
PHASE I
PHASE II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JANUARY SPECTRUM: 100-196 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
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3
3.5
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41
GAGES
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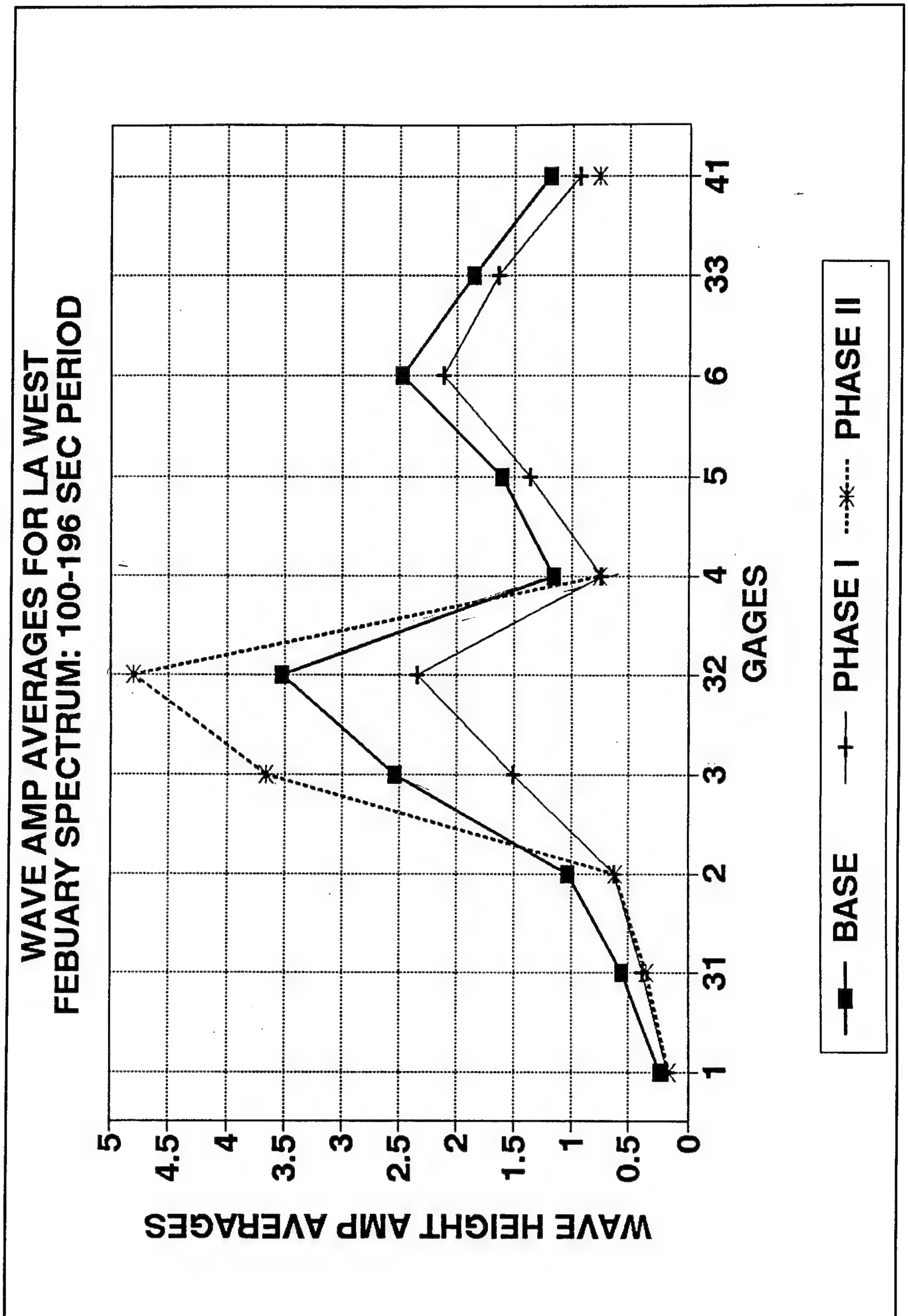
PHASE I
PHASE II

Plate 14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FEBUARY SPECTRUM: 100-196 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
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3
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4
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5
GAGES
1
31
2
3
32
4
5
6
33
41
BASE
PHASE I
PHASE II

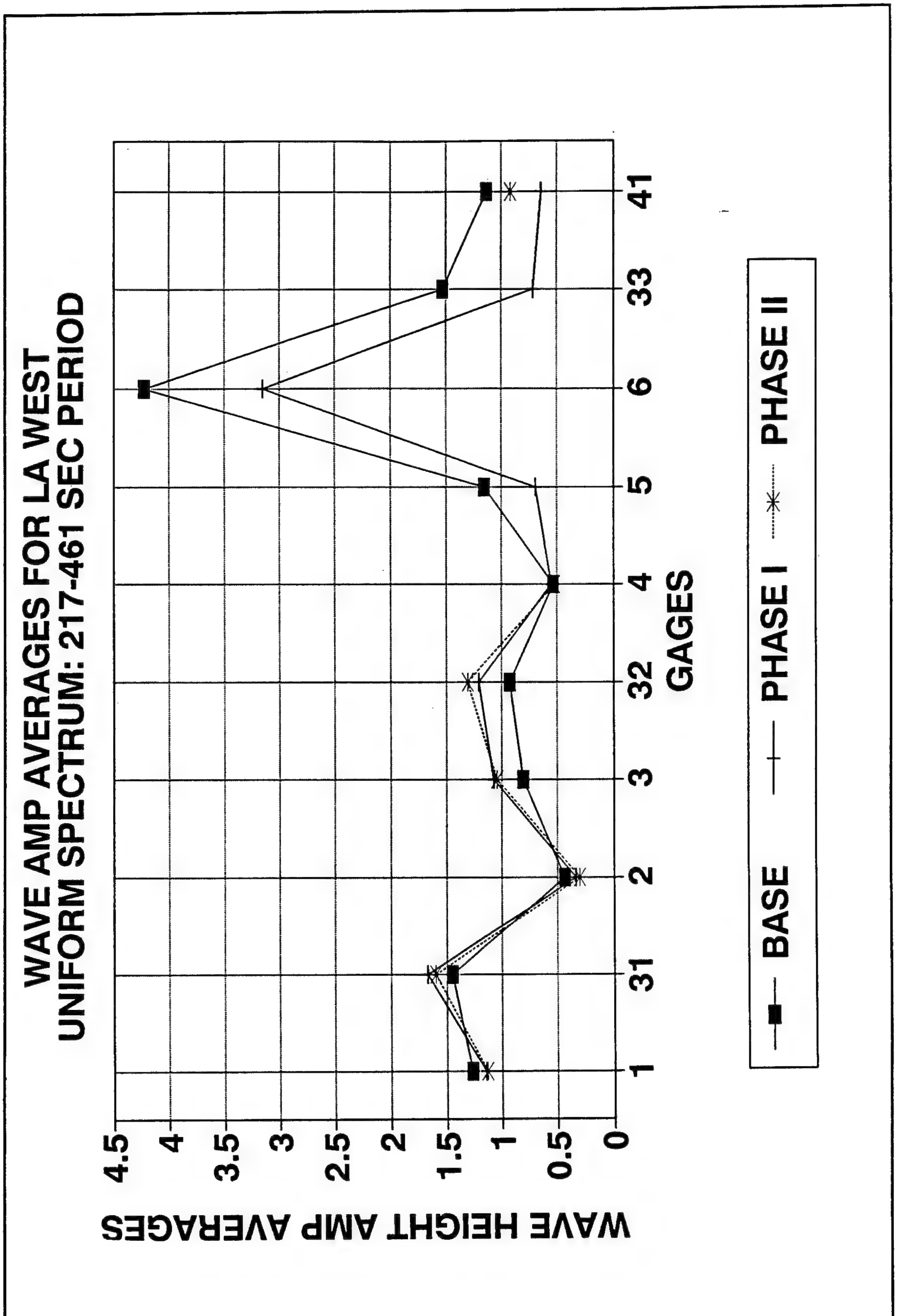
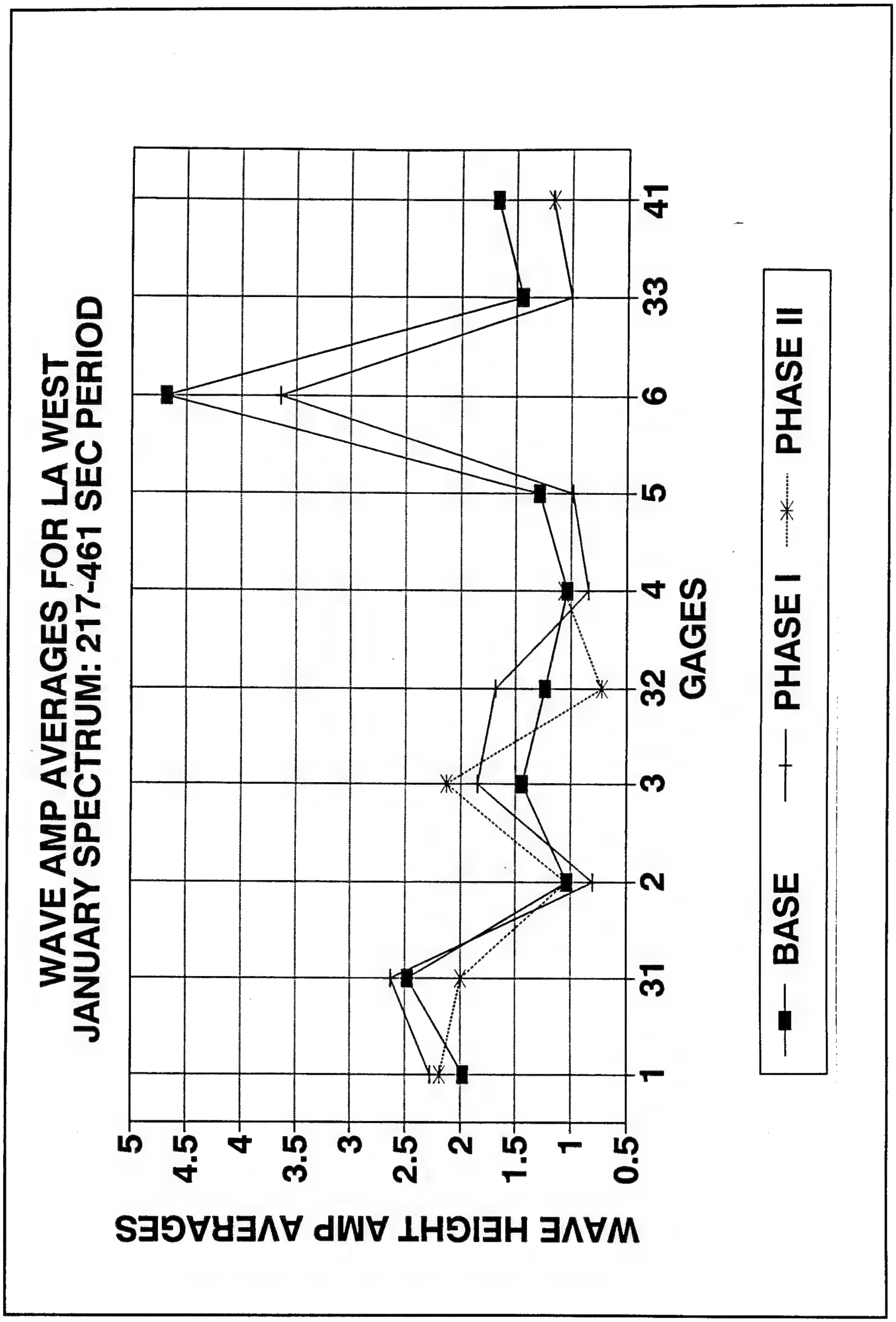

WAVE AMP AVERAGES FOR LA WEST
UNIFORM SPECTRUM: 217-461 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1
31
2
3
32
4
5
6
33
41
GAGES
BASE
PHASE I
PHASE II

Plate 16


WAVE AMP AVERAGES FOR LA WEST
JANUARY SPECTRUM: 217-461 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
5
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4
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2.5
2
1.5
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1
31
2
3
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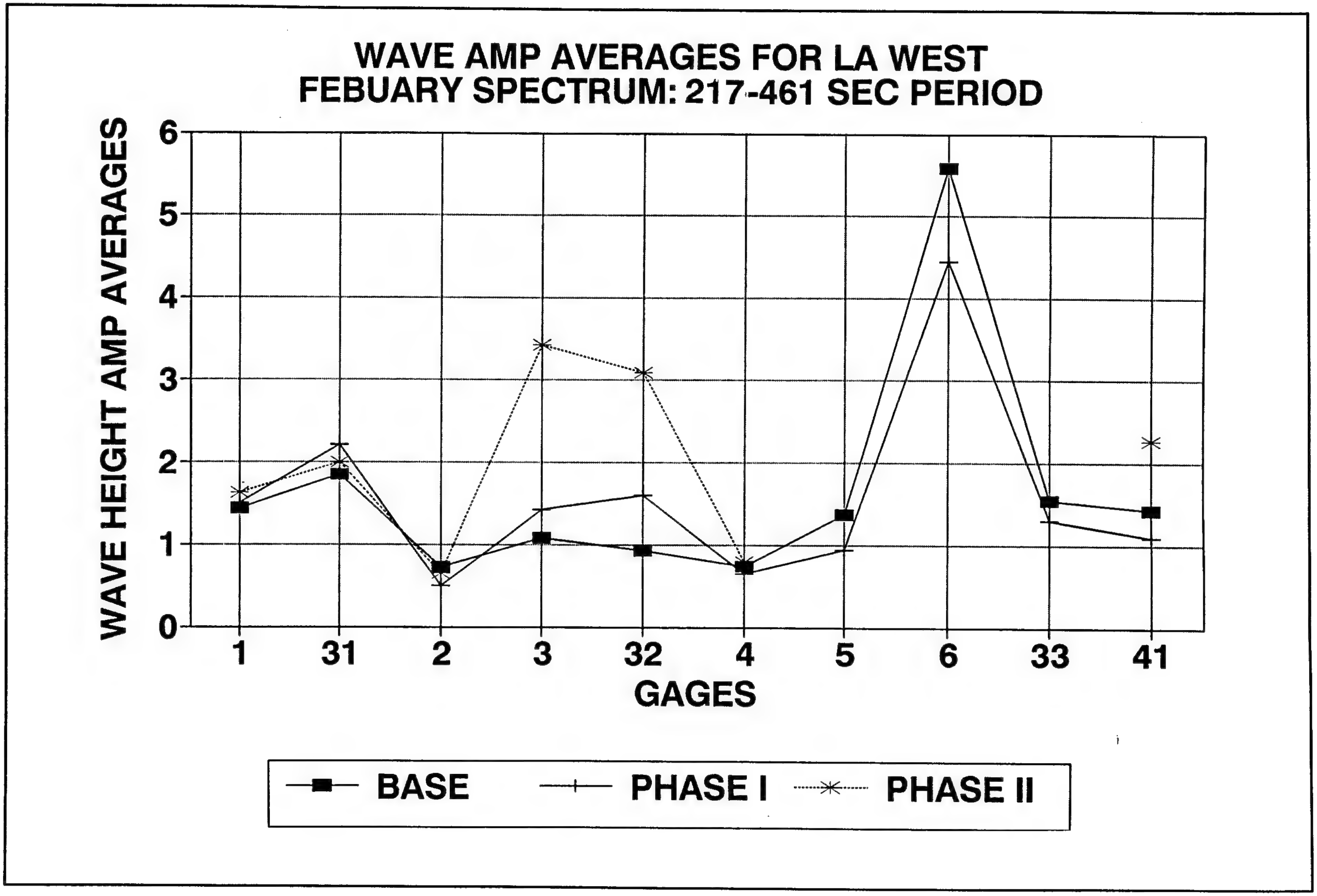
4
5
6
33
41
GAGES
BASE
PHASE I
PHASE II


WAVE AMP AVERAGES FOR LA WEST
FEBUARY SPECTRUM: 217-461 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
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1
2
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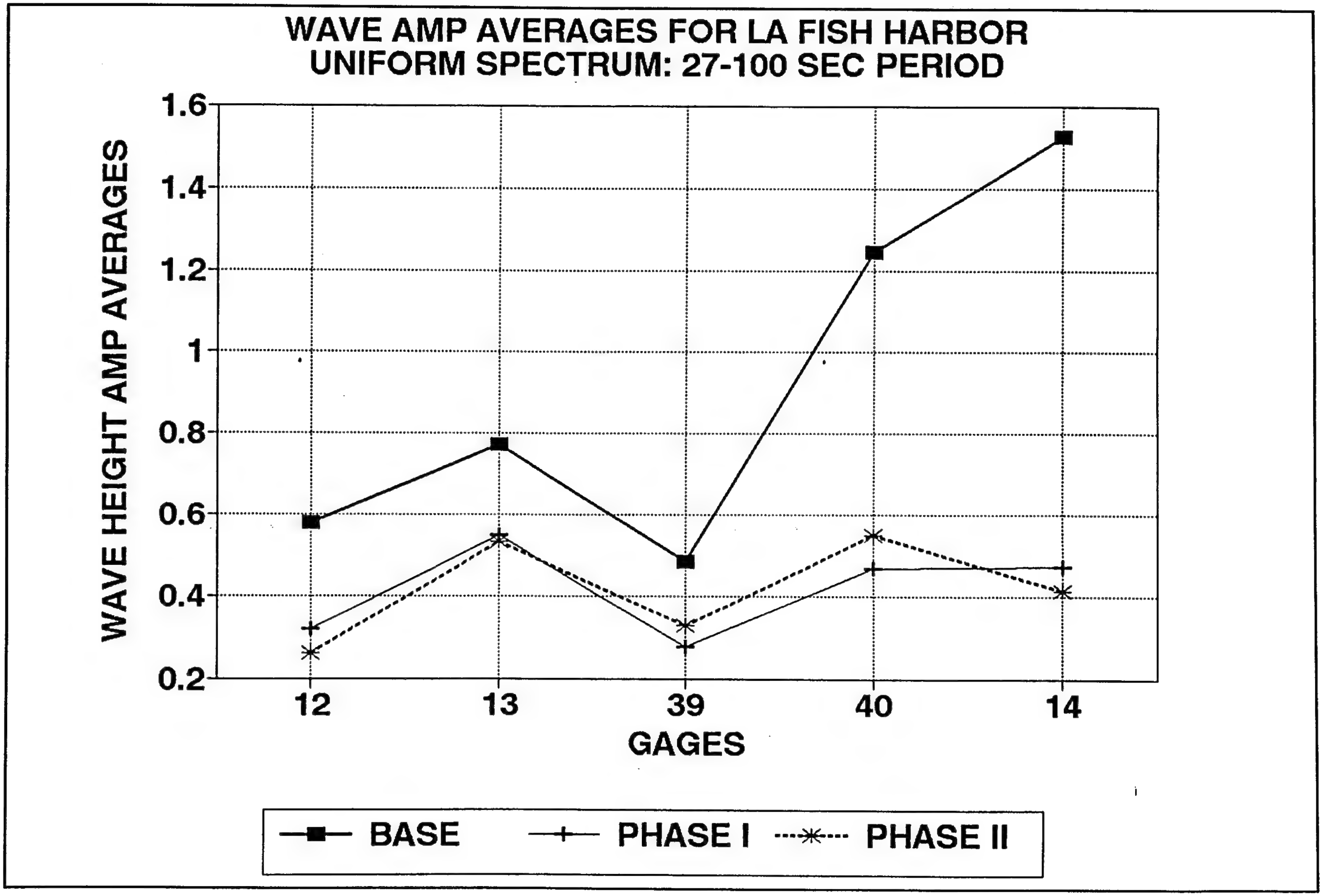
41
GAGES
BASE
PHASE I
PHASE II

Plate 18


WAVE AMP AVERAGES FOR LA FISH HARBOR
UNIFORM SPECTRUM: 27-100 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
1.6
1.4
1.2
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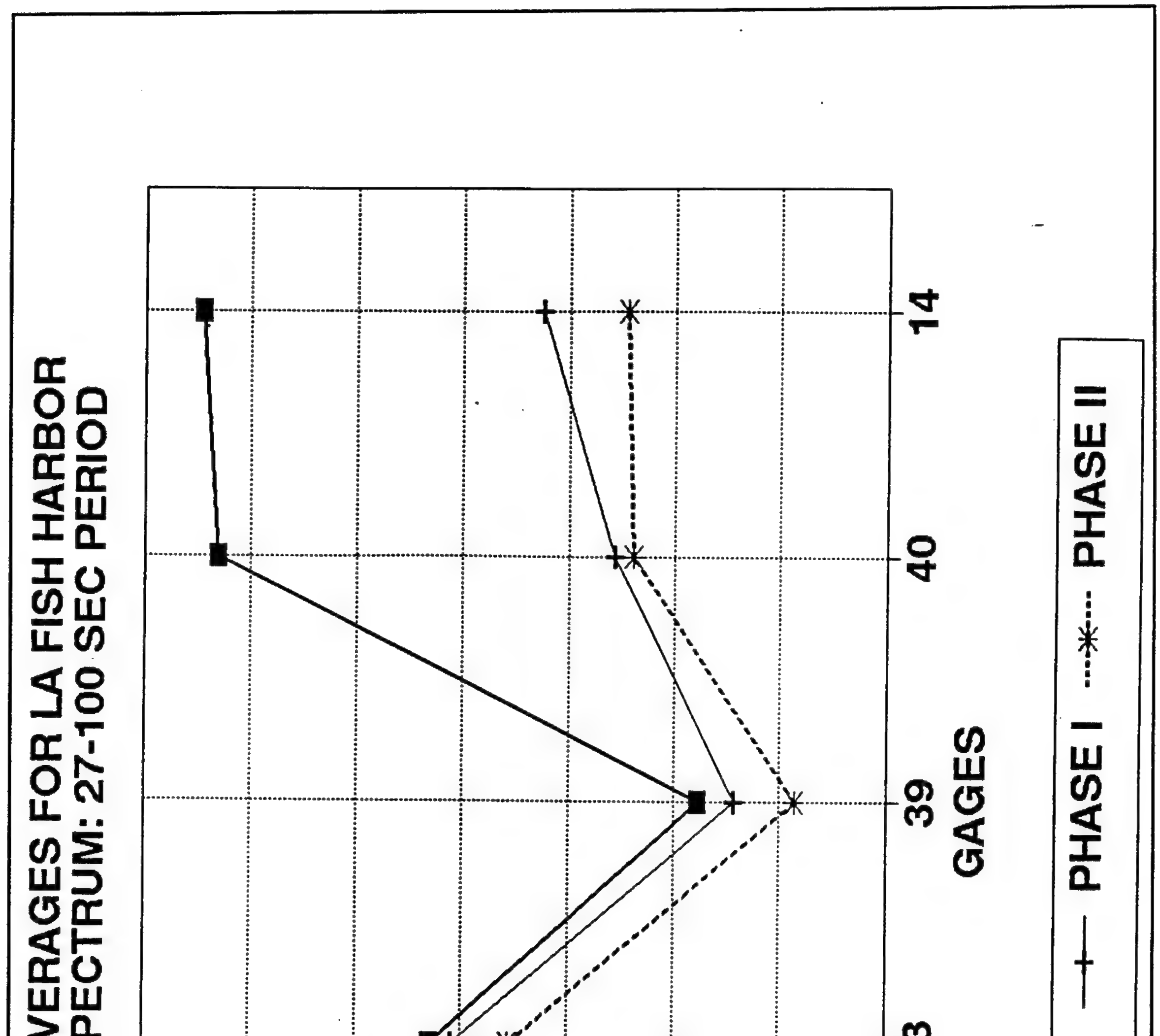
0.8
0.6
0.4
0.2
12
13
39
40
14
GAGES
BASE
PHASE I
PHASE II

Plate 19


WAVE AMP AVERAGES FOR LA FISH HARBOR
JANUARY SPECTRUM: 27-100 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
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1.4
1.2
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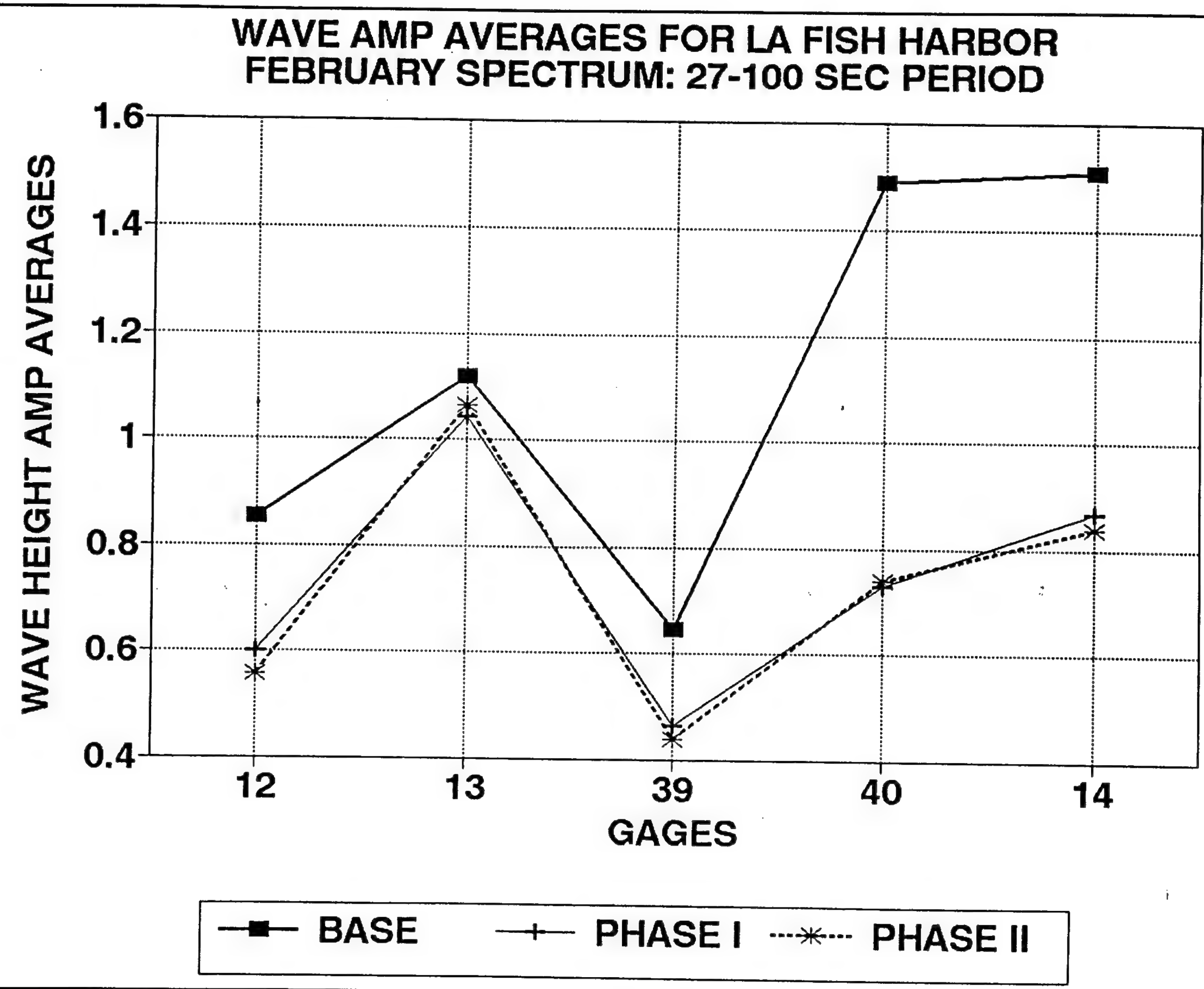
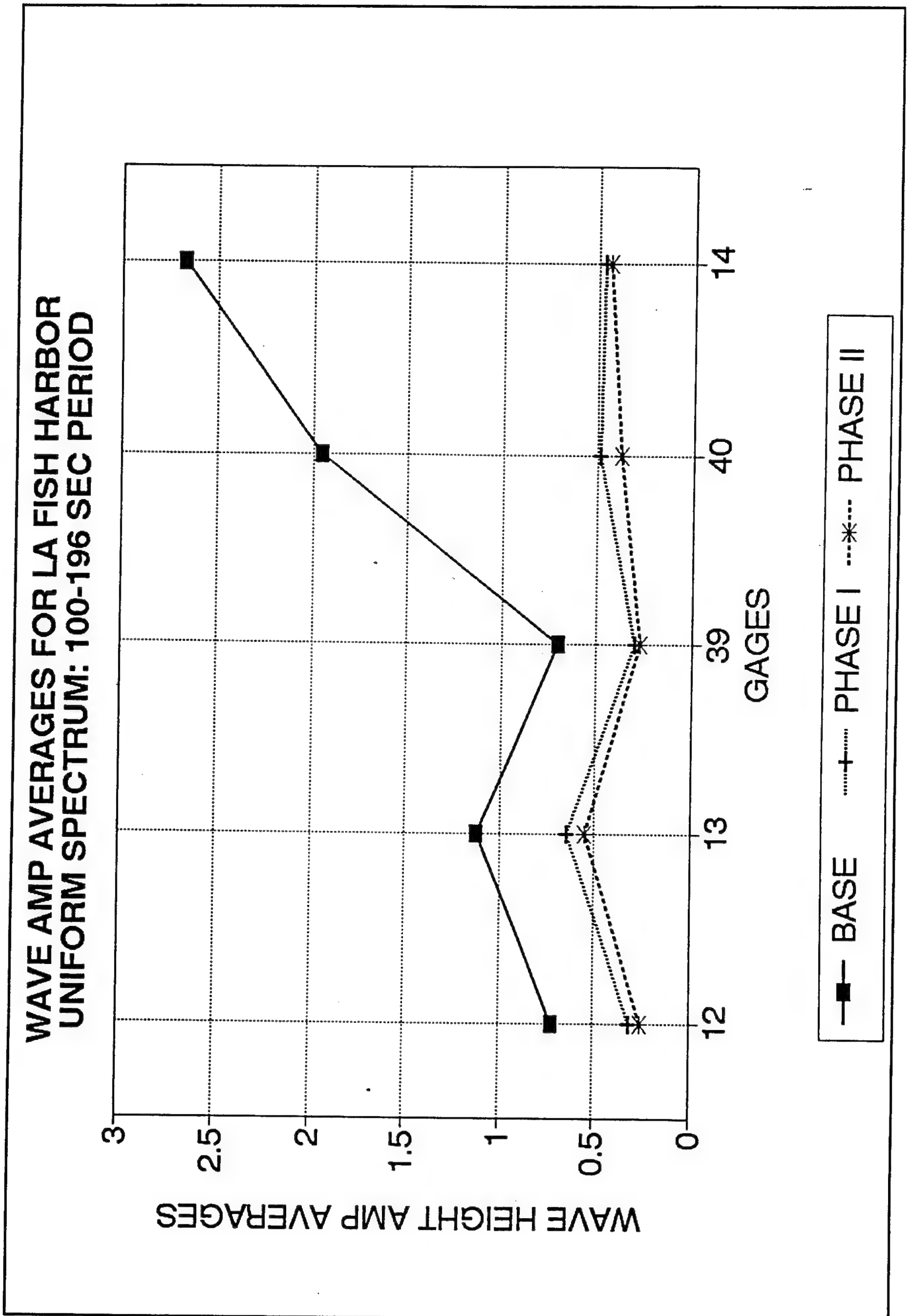
0.4
0.2
12
13
39
40
14
GAGES
BASE
PHASE I
PHASE II

Plate 20



WAVE AMP AVERAGES FOR LA FISH HARBOR
FEBRUARY SPECTRUM: 27-100 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
1.6
1.4
1.2
1
0.8
0.6
0.4
12
13
39
40
14
GAGES
BASE
PHASE I
PHASE II


WAVE AMP AVERAGES FOR LA FISH HARBOR
UNIFORM SPECTRUM: 100-196 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
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0.5
1
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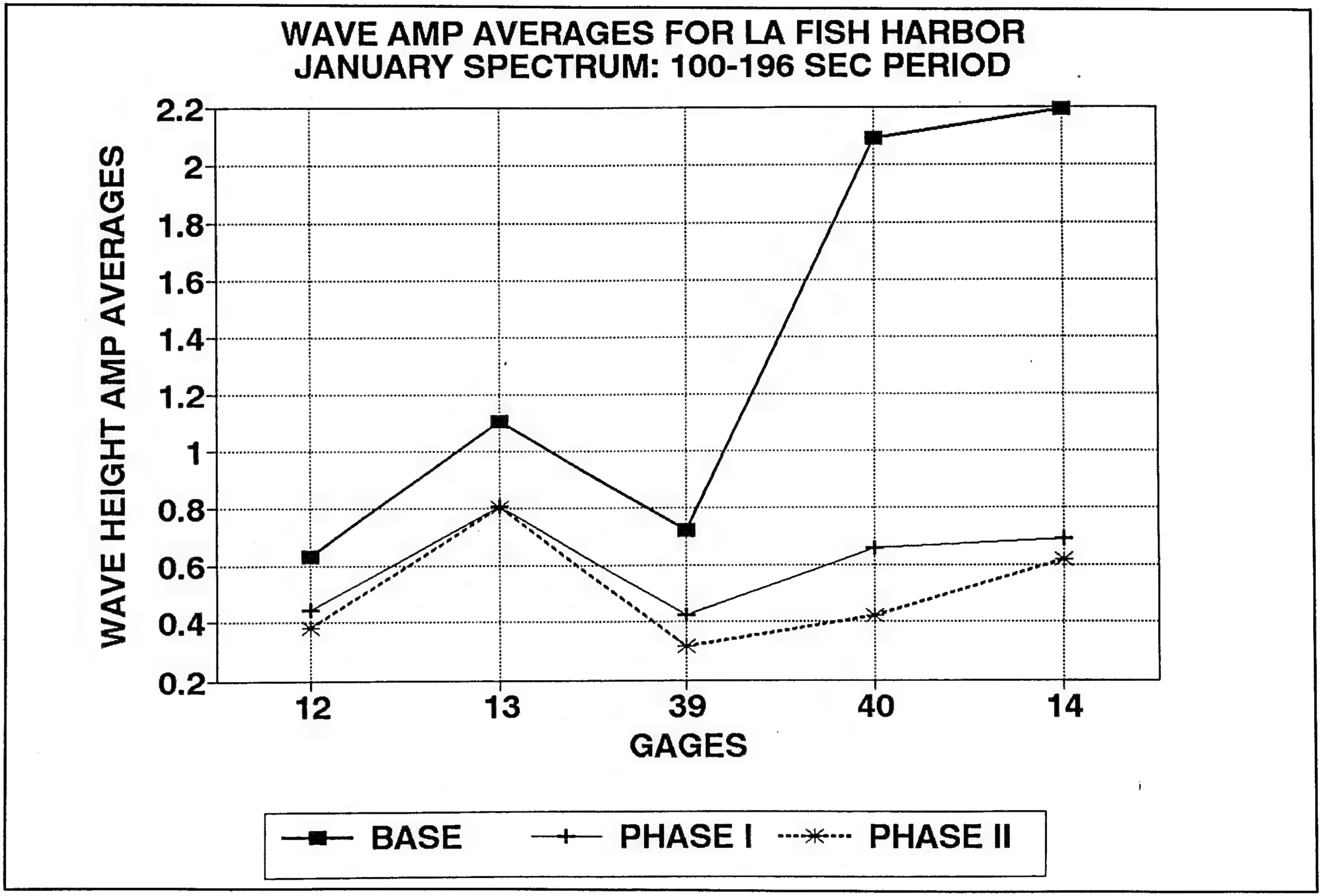
2
2.5
3
12
13
39
40
14
GAGES
BASE
PHASE I
PHASE II

Plate 22


WAVE AMP AVERAGES FOR LA FISH HARBOR
JANUARY SPECTRUM: 100-196 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
12
13
39
40
14
GAGES
BASE
PHASE I
PHASE II

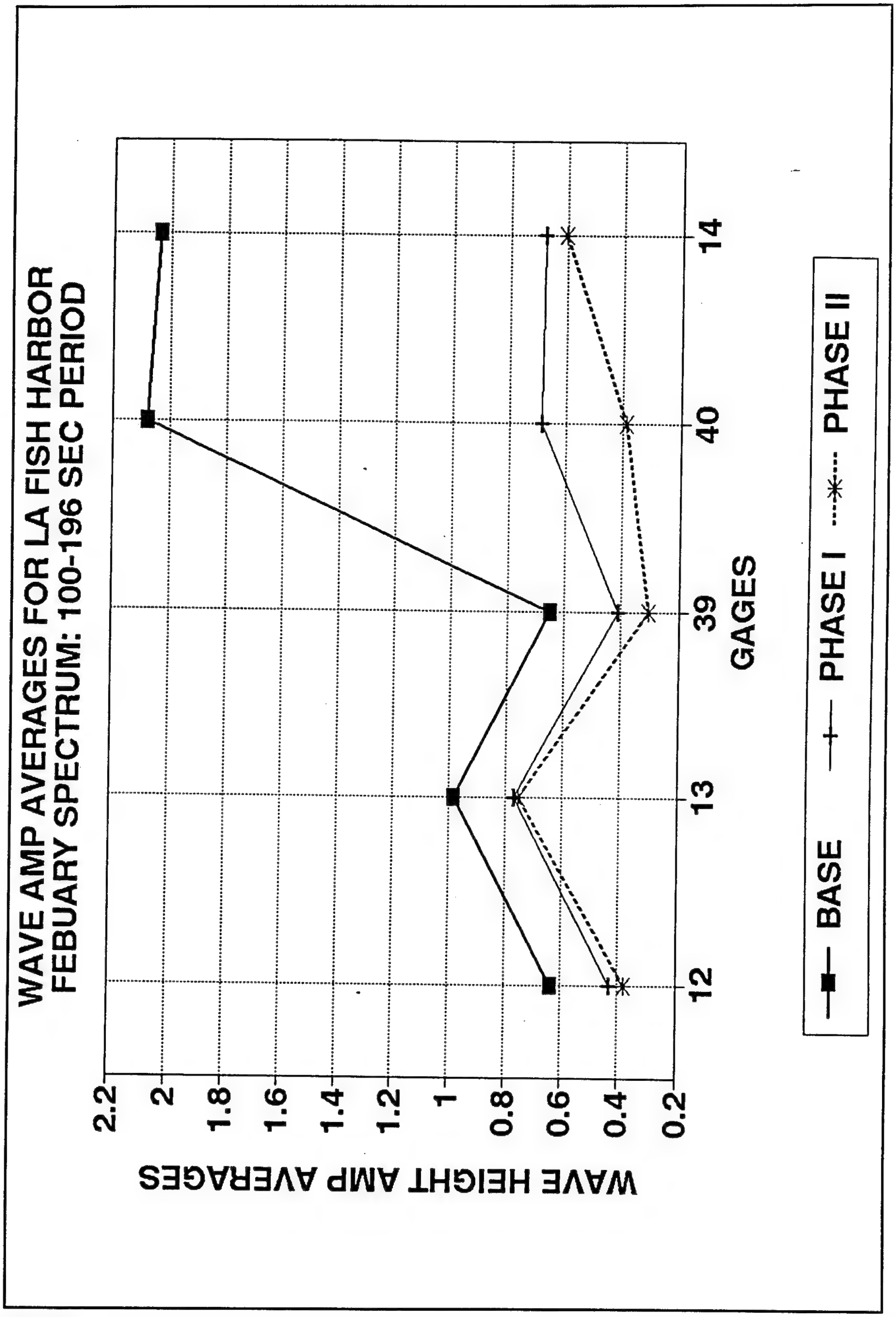

WAVE AMP AVERAGES FOR LA FISH HARBOR
FEBUARY SPECTRUM: 100-196 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
12
13
39
40
14
GAGES
BASE
PHASE I
PHASE II

Plate 24

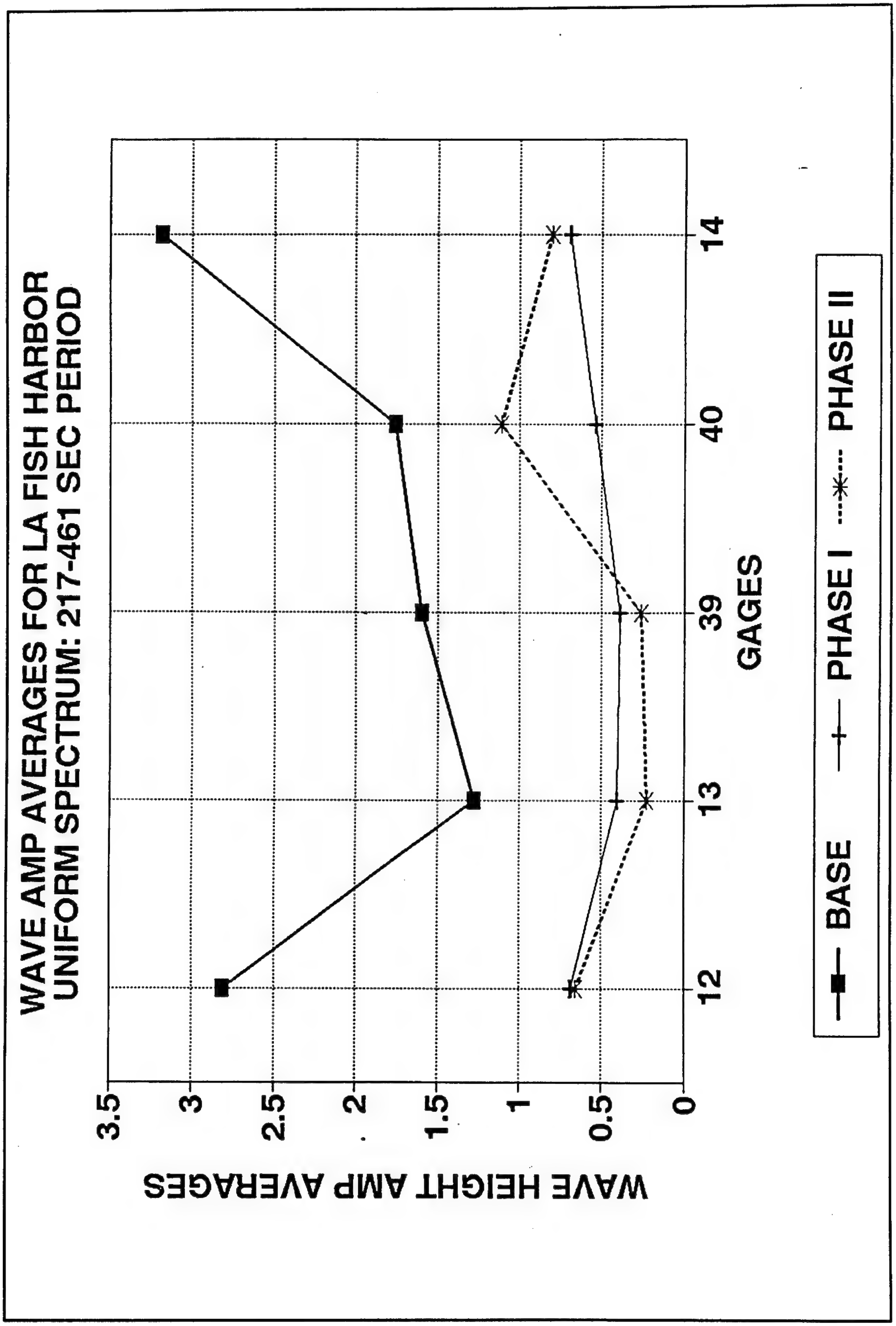
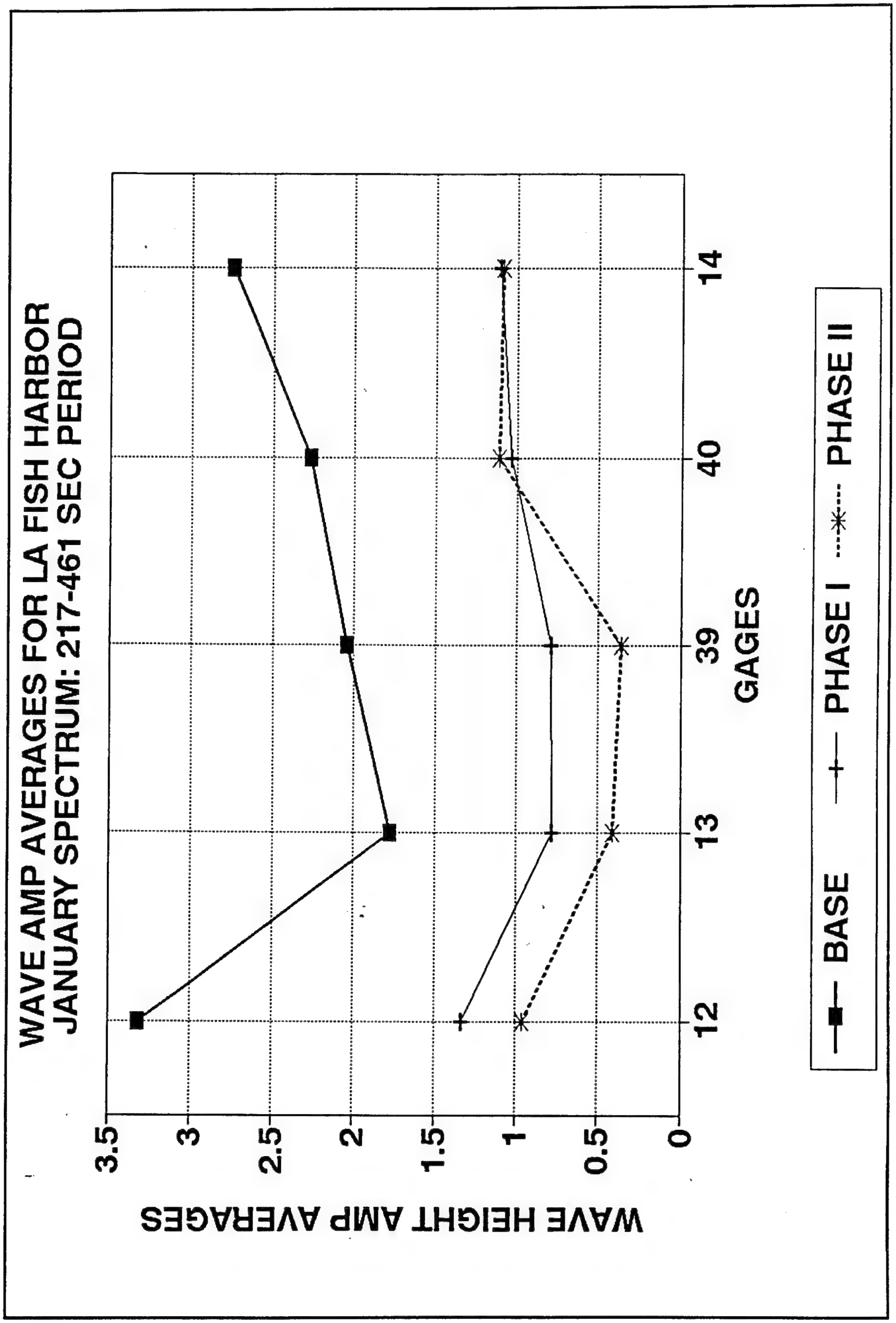

WAVE AMP AVERAGES FOR LA FISH HARBOR
UNIFORM SPECTRUM: 217-461 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
0
0.5
1
1.5
2
2.5
3
3.5
12
13
39
40
14
GAGES
BASE
PHASE I
PHASE II

Plate 25



WAVE AMP AVERAGES FOR LA FISH HARBOR
JANUARY SPECTRUM: 217-461 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
0
0.5
1
1.5
2
2.5
3
3.5
12
13
39
40
14
GAGES
BASE
PHASE I
PHASE II


Plate 26

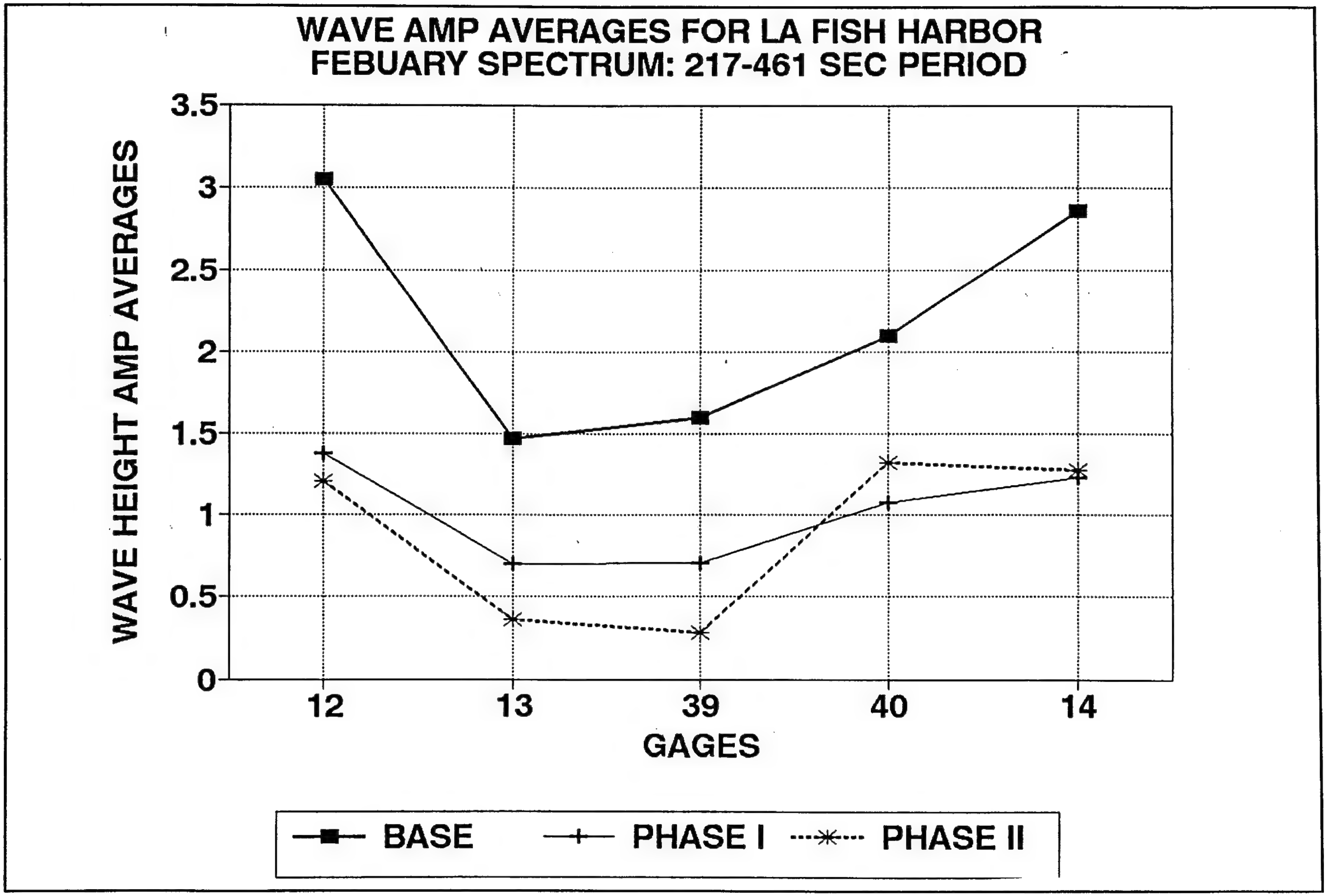
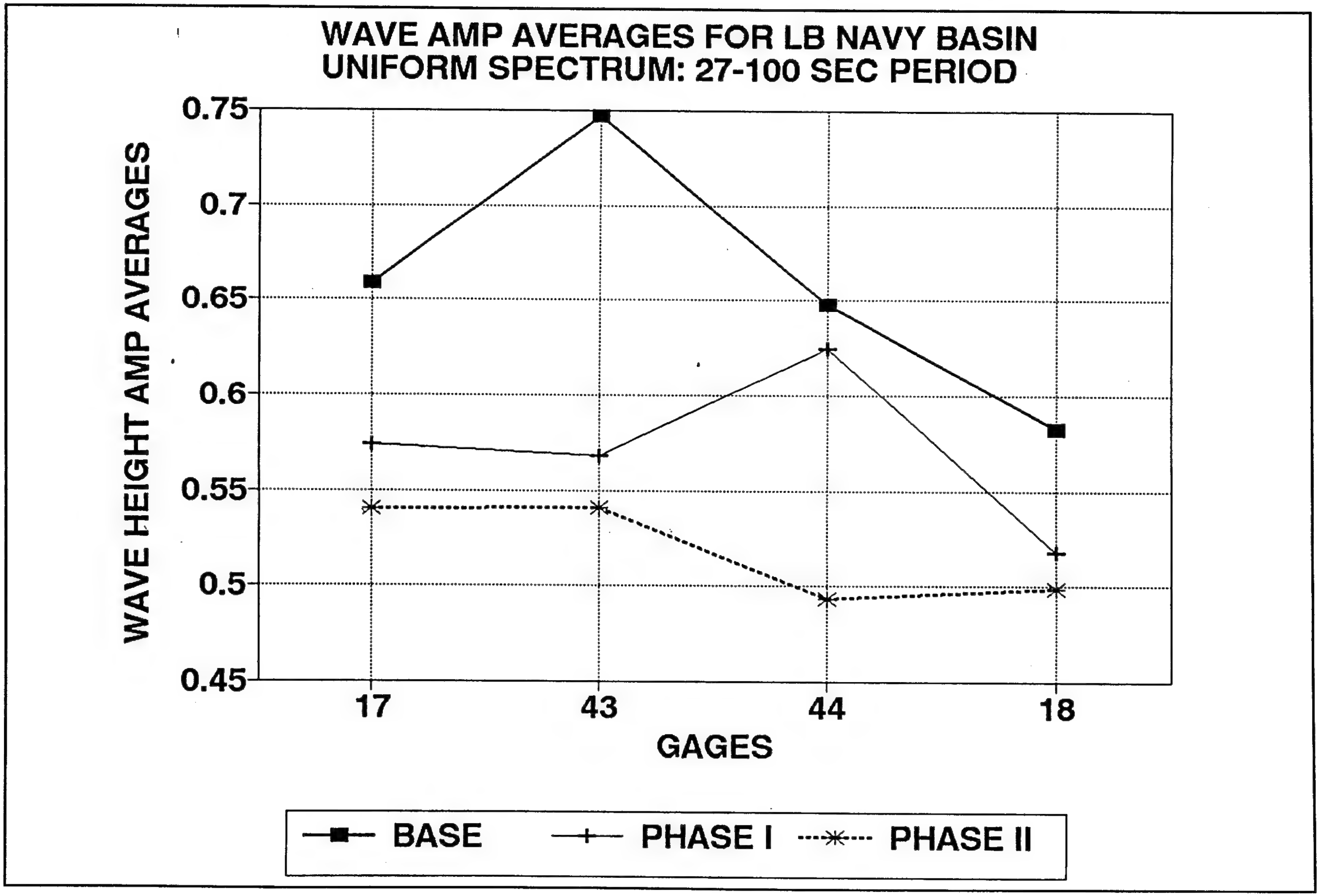
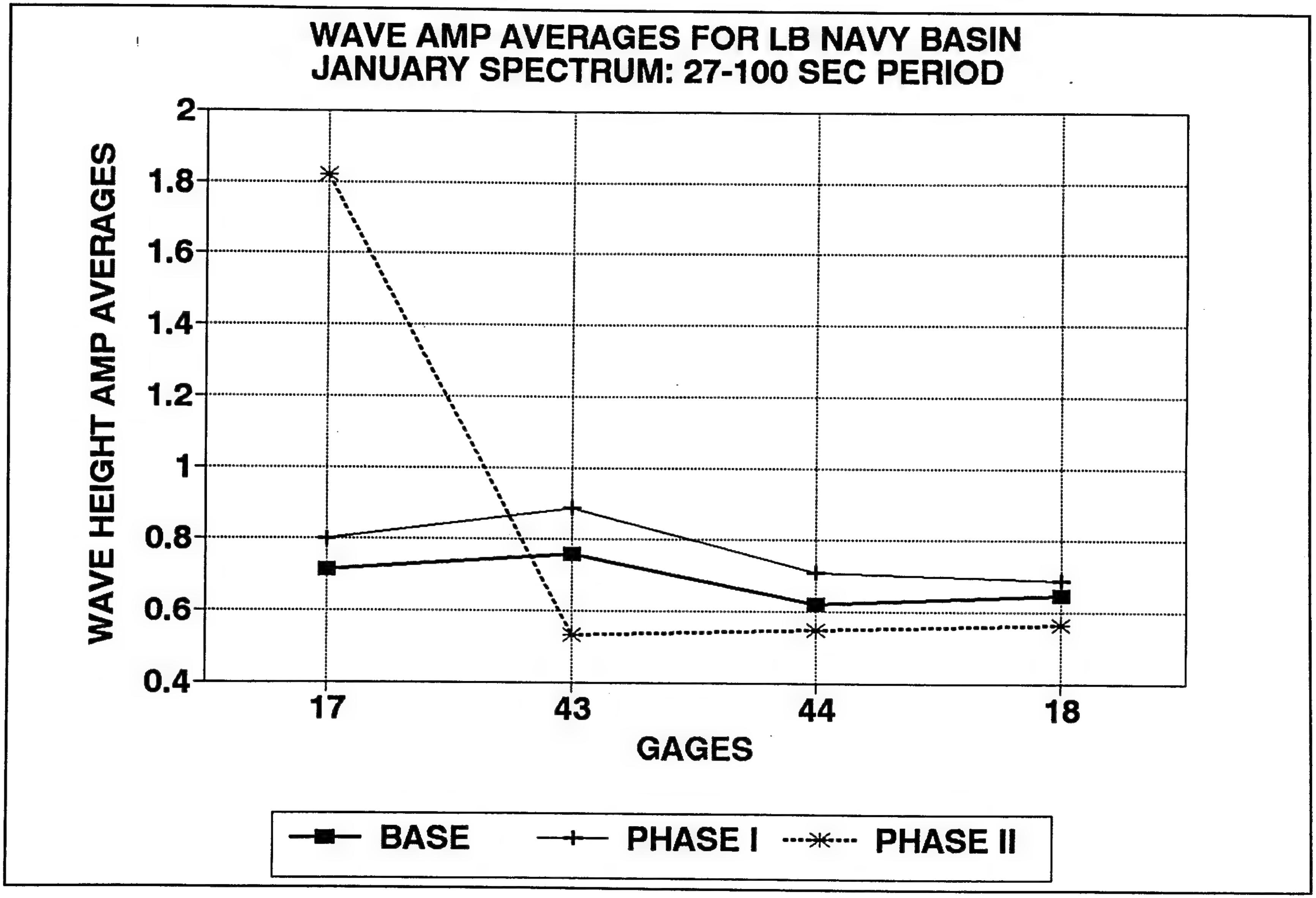

WAVE AMP AVERAGES FOR LA FISH HARBOR
FEBUARY SPECTRUM: 217-461 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
3.5
3
2.5
2
1.5
1
0.5
0
12
13
39
40
14
GAGES
BASE
PHASE I
PHASE II

Plate 28



WAVE AMP AVERAGES FOR LB NAVY BASIN
UNIFORM SPECTRUM: 27-100 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
0.75
0.7
0.65
0.6
0.55
0.5
0.45
17
43
44
18
GAGES
BASE
PHASE I
PHASE II


WAVE AMP AVERAGES FOR LB NAVY BASIN
JANUARY SPECTRUM: 27-100 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
17
43
44
18
GAGES
BASE
PHASE I
PHASE II

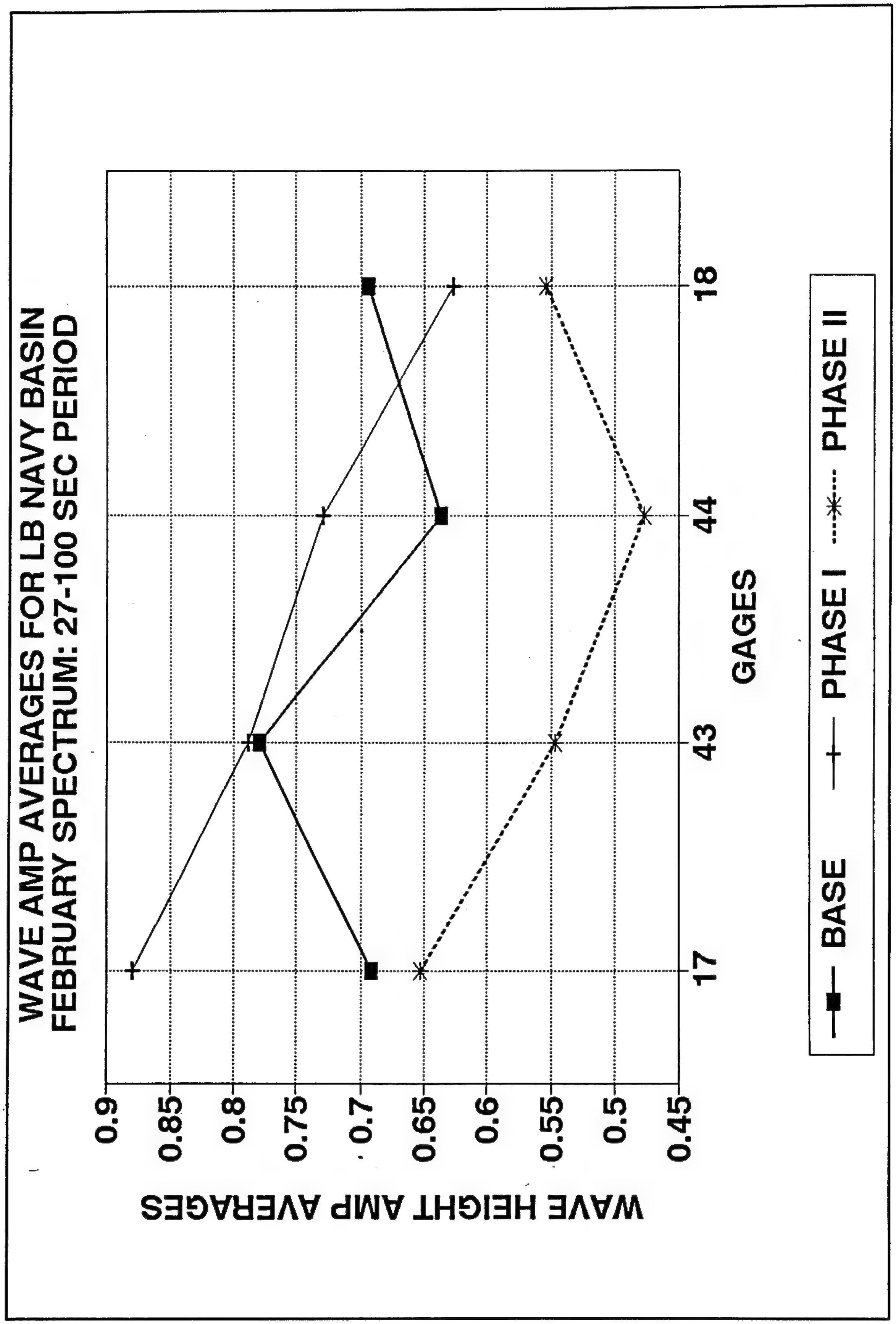
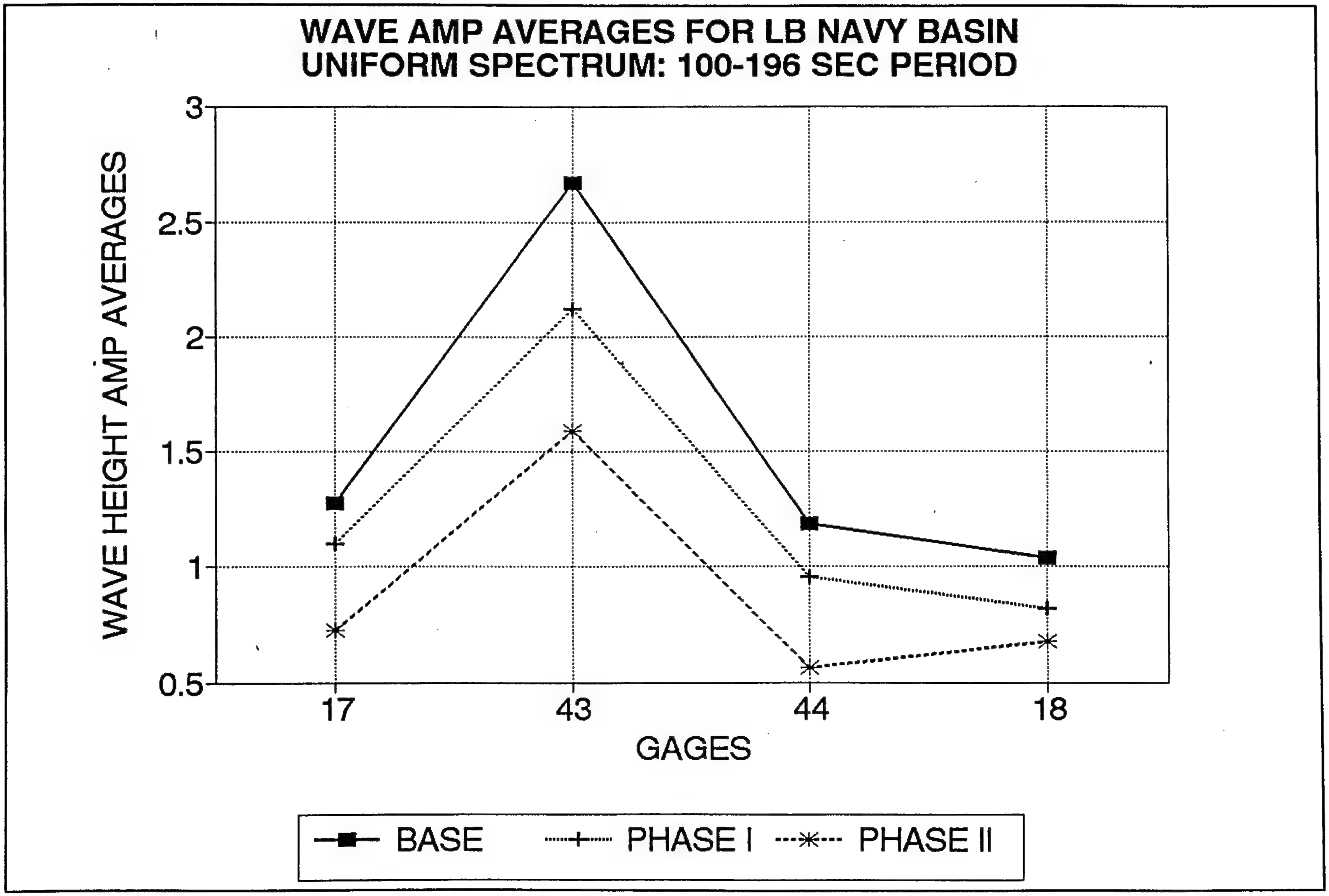

WAVE AMP AVERAGES FOR LB NAVY BASIN
FEBRUARY SPECTRUM: 27-100 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
0.45
GAGES
17
43
44
18
BASE
PHASE I
PHASE II

Plate 30



WAVE AMP AVERAGES FOR LB NAVY BASIN
UNIFORM SPECTRUM: 100-196 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
3
2.5
2
1.5
1
0.5
17
43
44
18
GAGES
BASE
PHASE I
PHASE II

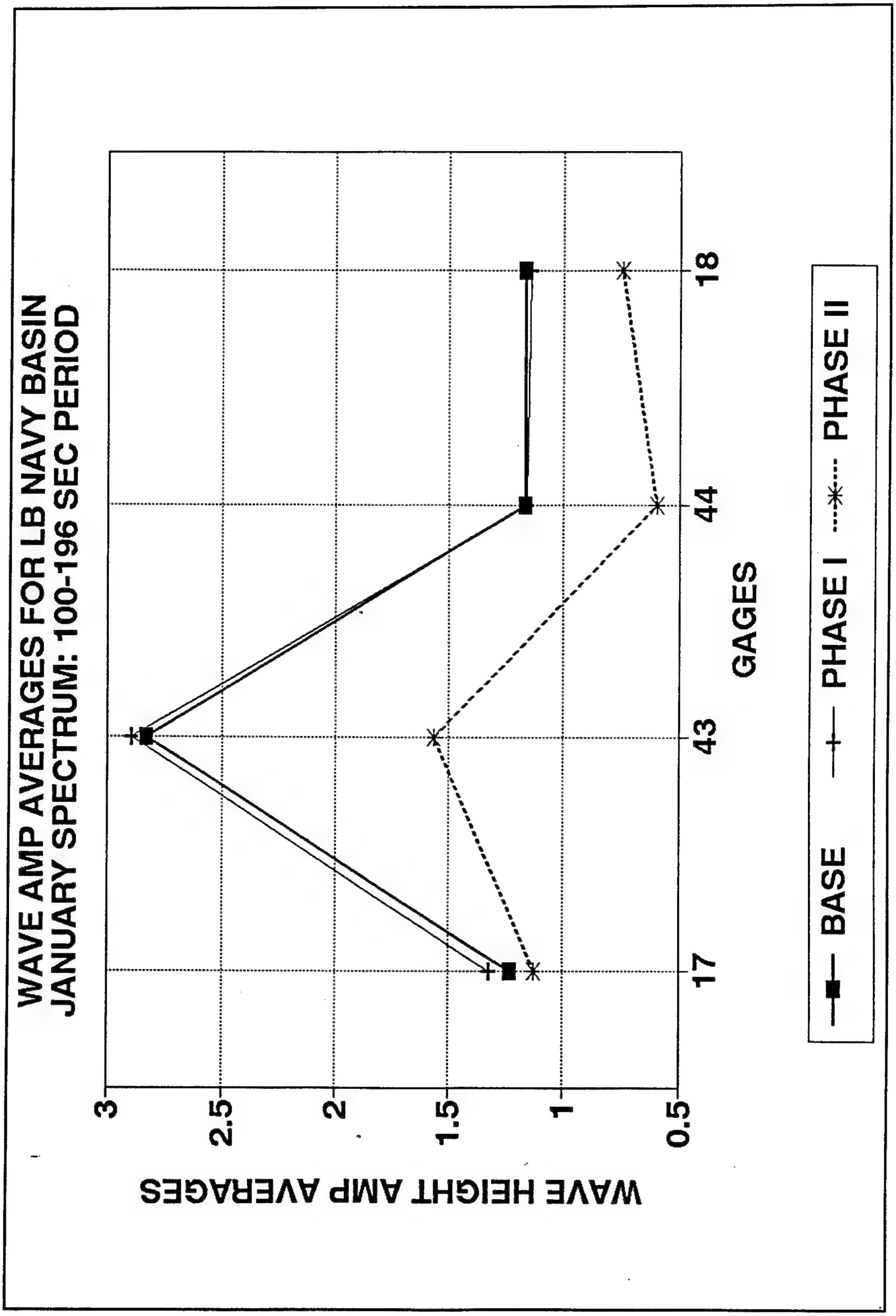
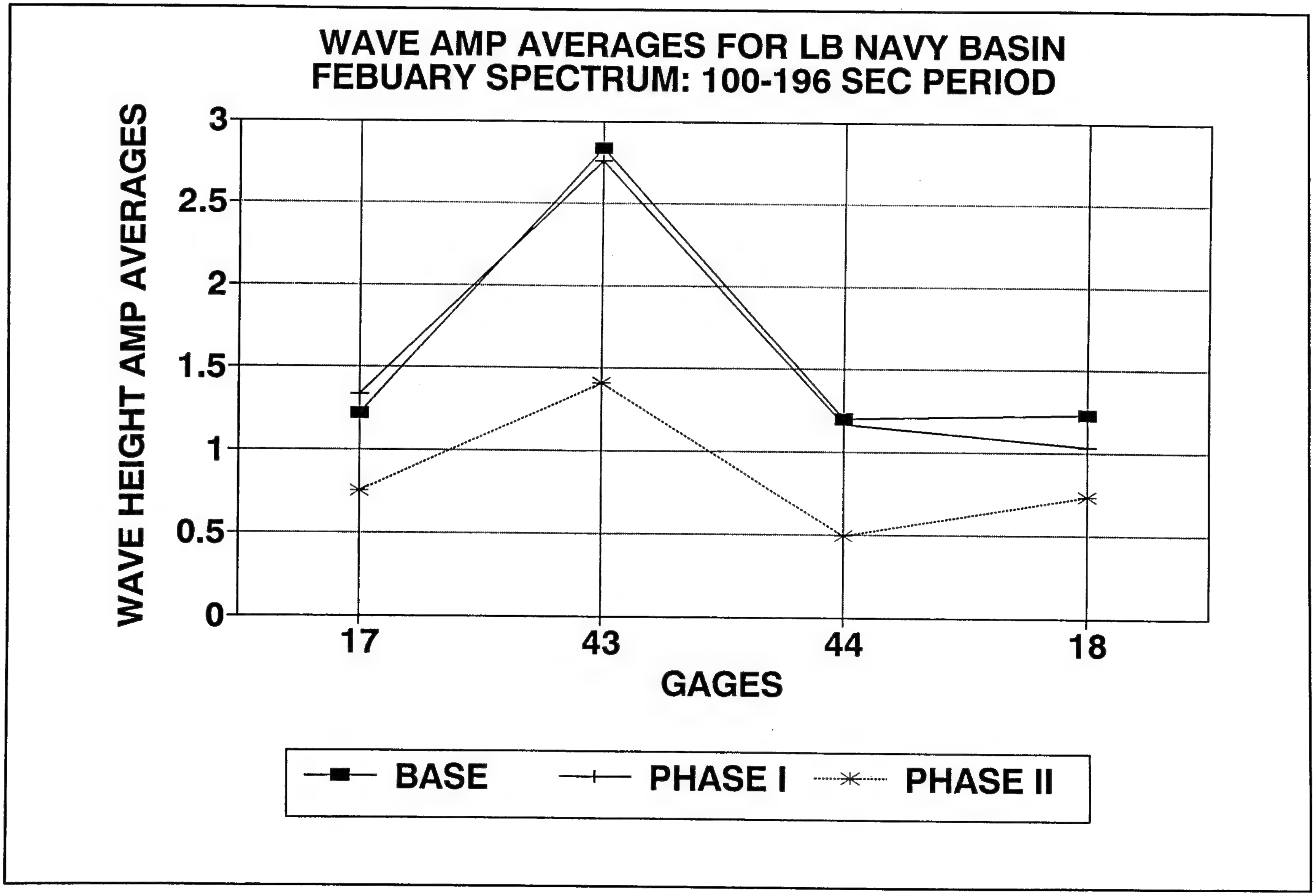

WAVE AMP AVERAGES FOR LB NAVY BASIN
JANUARY SPECTRUM: 100-196 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
3
2.5
2
1.5
1
0.5
17
43
44
18
GAGES
BASE
PHASE I
PHASE II

Plate 32



WAVE AMP AVERAGES FOR LB NAVY BASIN
FEBUARY SPECTRUM: 100-196 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
3
2.5
2
1.5
1
0.5
0
17
43
44
18
GAGES
BASE
PHASE I
PHASE II

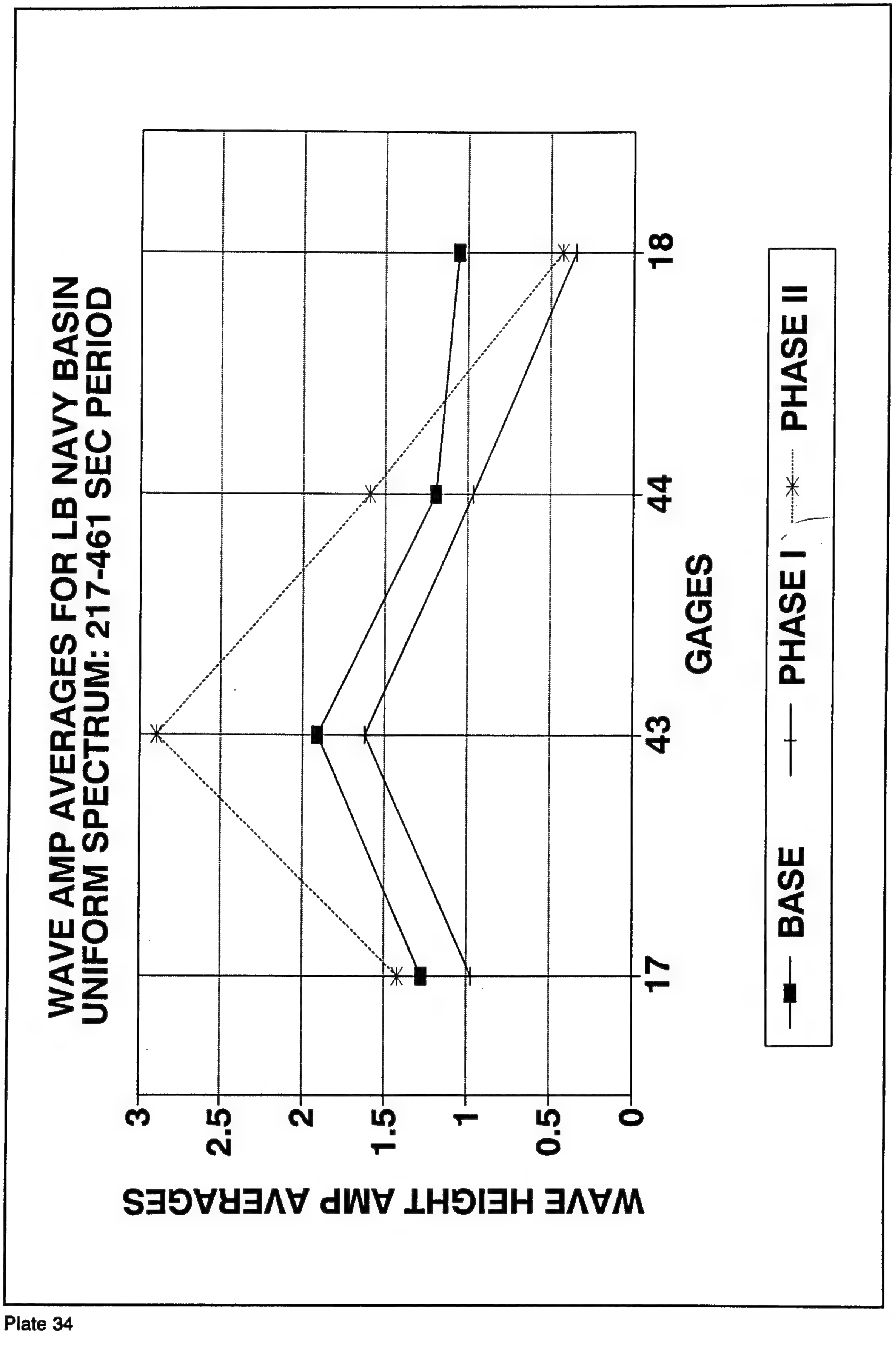

WAVE AMP AVERAGES FOR LB NAVY BASIN
UNIFORM SPECTRUM: 217-461 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
3
2.5
2
1.5
1
0.5
0
17
43
44
18
GAGES
BASE
PHASE I
PHASE II

Plate 34

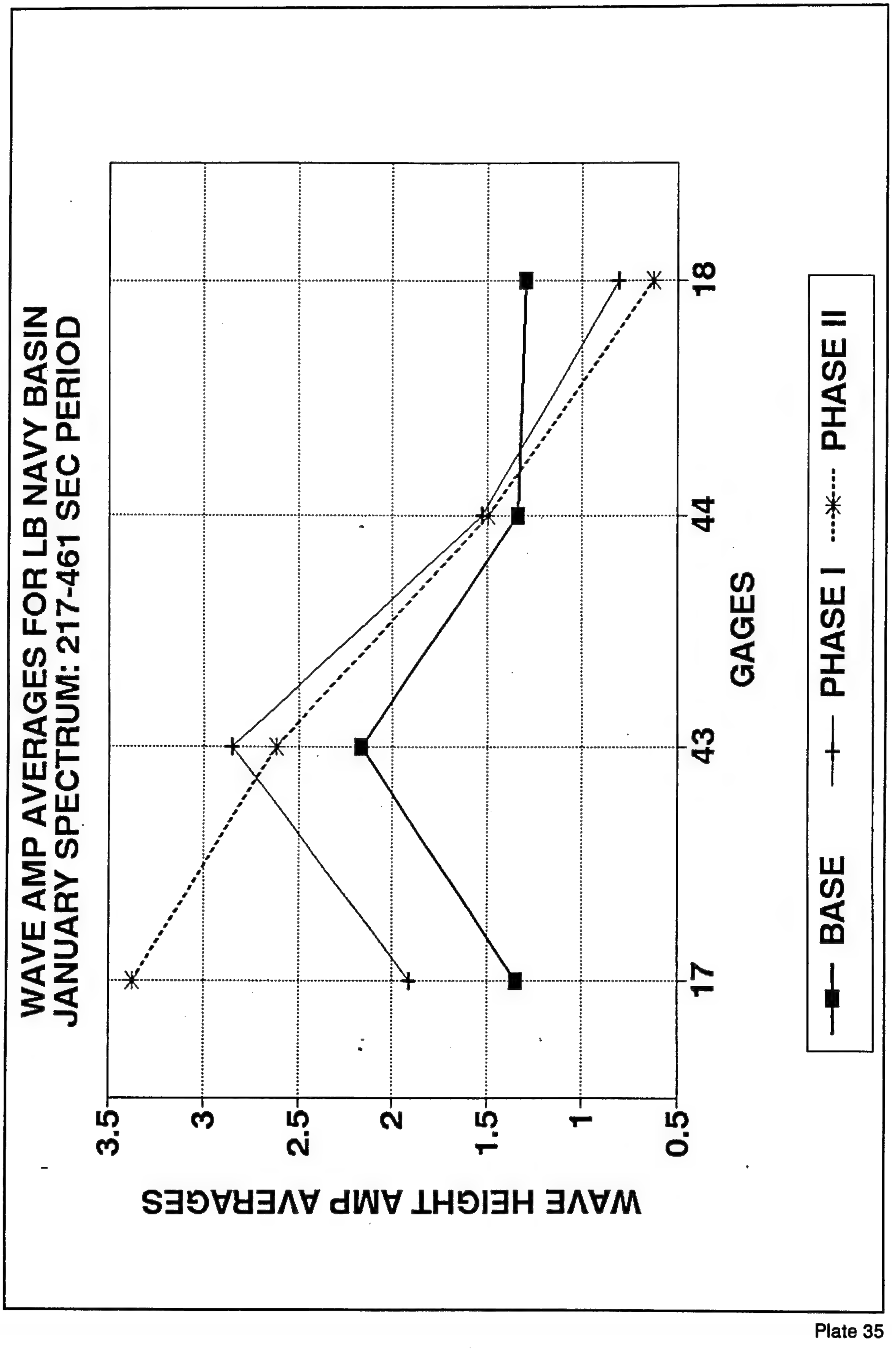
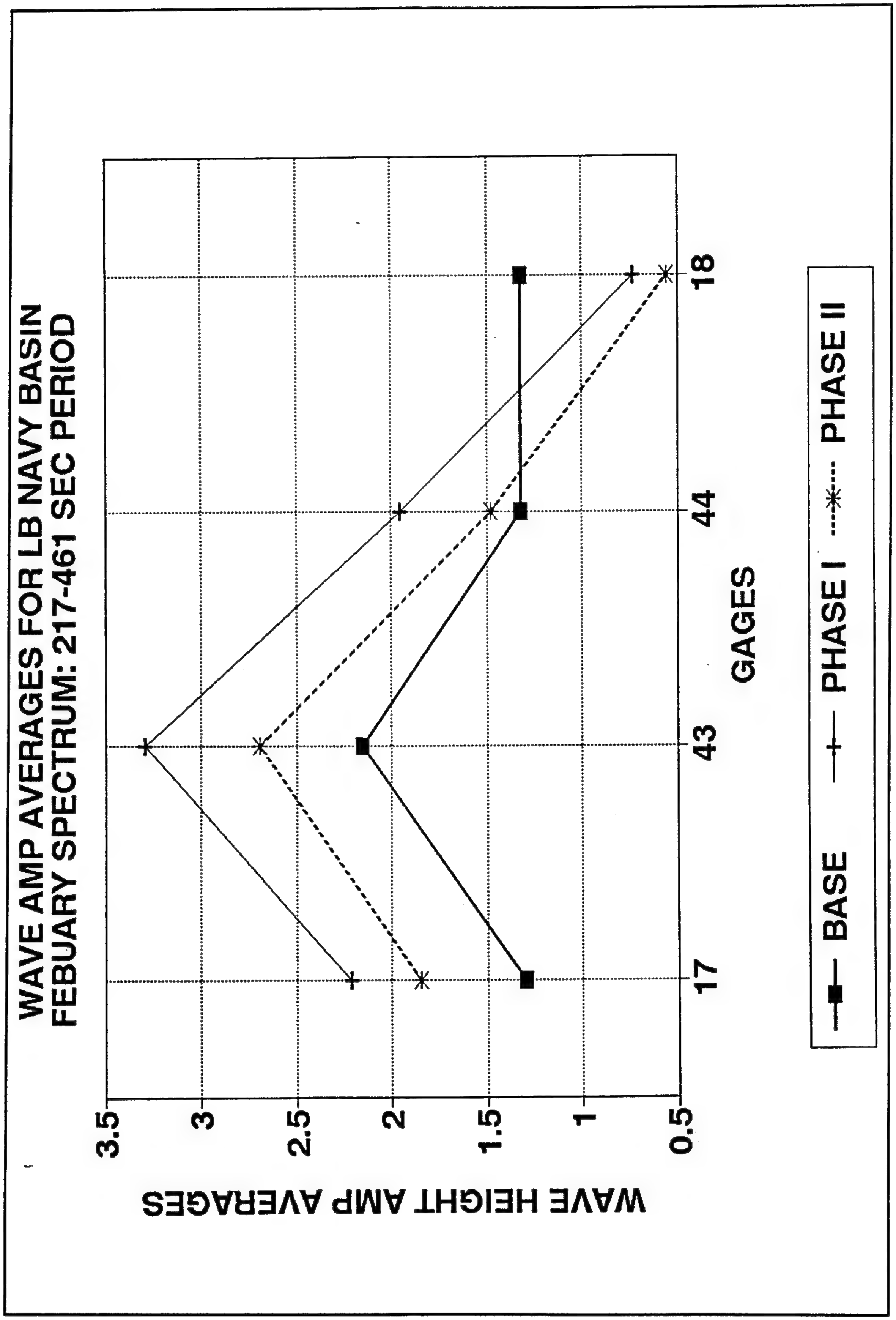
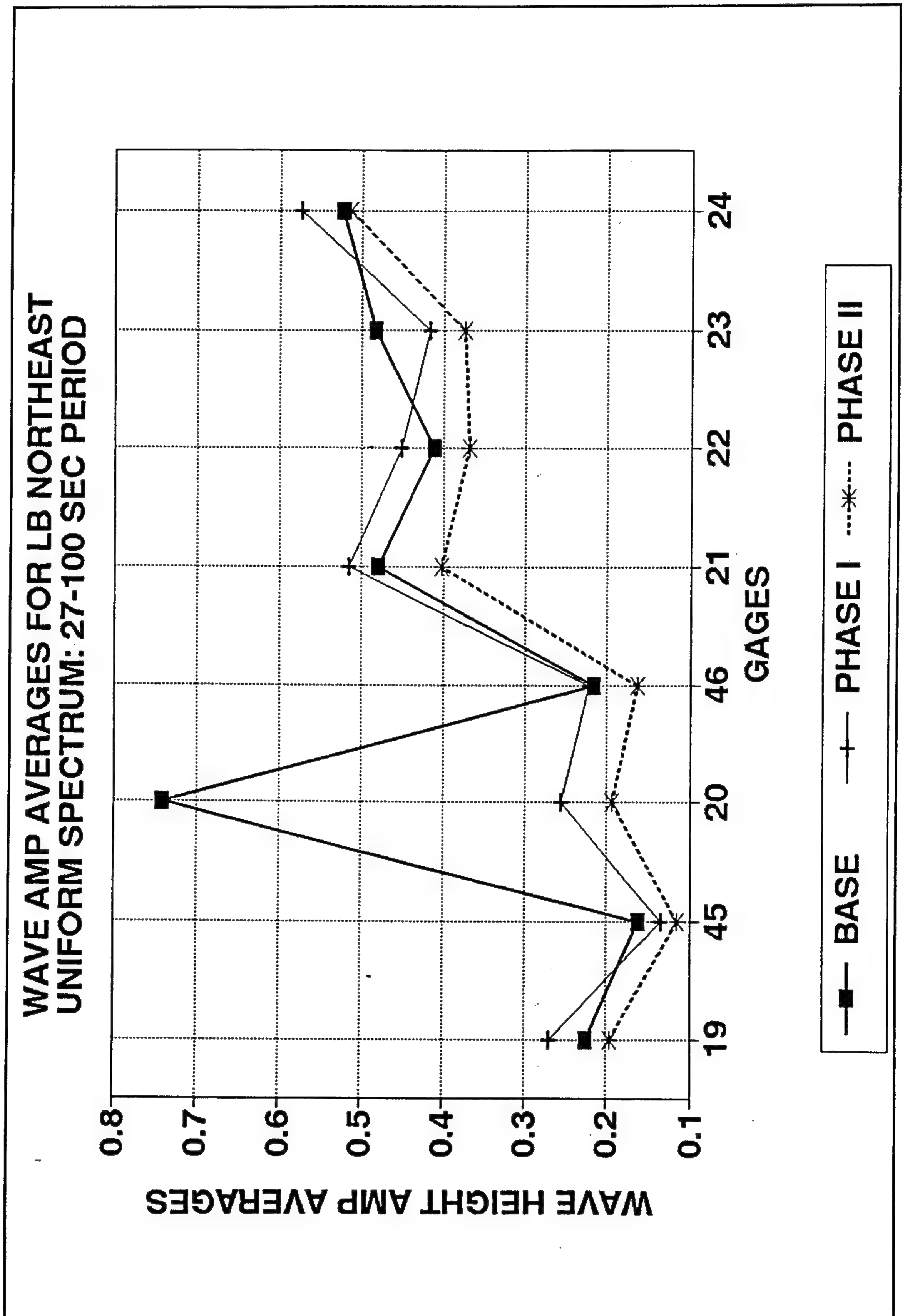

WAVE AMP AVERAGES FOR LB NAVY BASIN
JANUARY SPECTRUM: 217-461 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
3.5
3
2.5
2
1.5
1
0.5
17
43
44
18
GAGES
BASE
PHASE I
PHASE II

Plate 35



WAVE AMP AVERAGES FOR LB NAVY BASIN
FEBUARY SPECTRUM: 217-461 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
3.5
3
2.5
2
1.5
1
0.5
17
43
44
18
GAGES
BASE
PHASE I
PHASE II


Plate 36



WAVE AMP AVERAGES FOR LB NORTHEAST
UNIFORM SPECTRUM: 27-100 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
19
45
20
46
21
22
23
24
GAGES
BASE
PHASE I
PHASE II

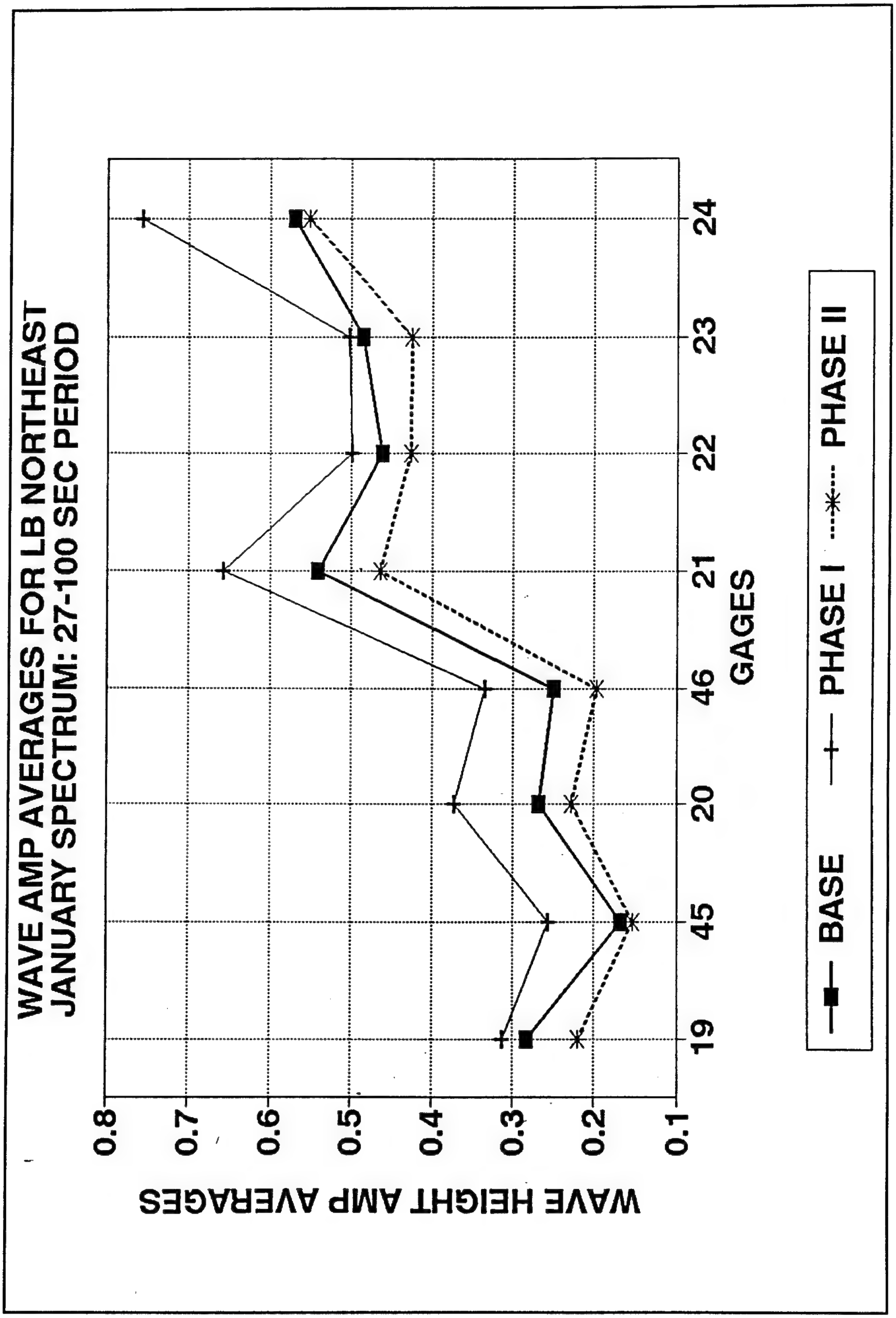

WAVE AMP AVERAGES FOR LB NORTHEAST
JANUARY SPECTRUM: 27-100 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
GAGES
19
45
20
46
21
22
23
24
BASE
PHASE I
PHASE II

Plate 38

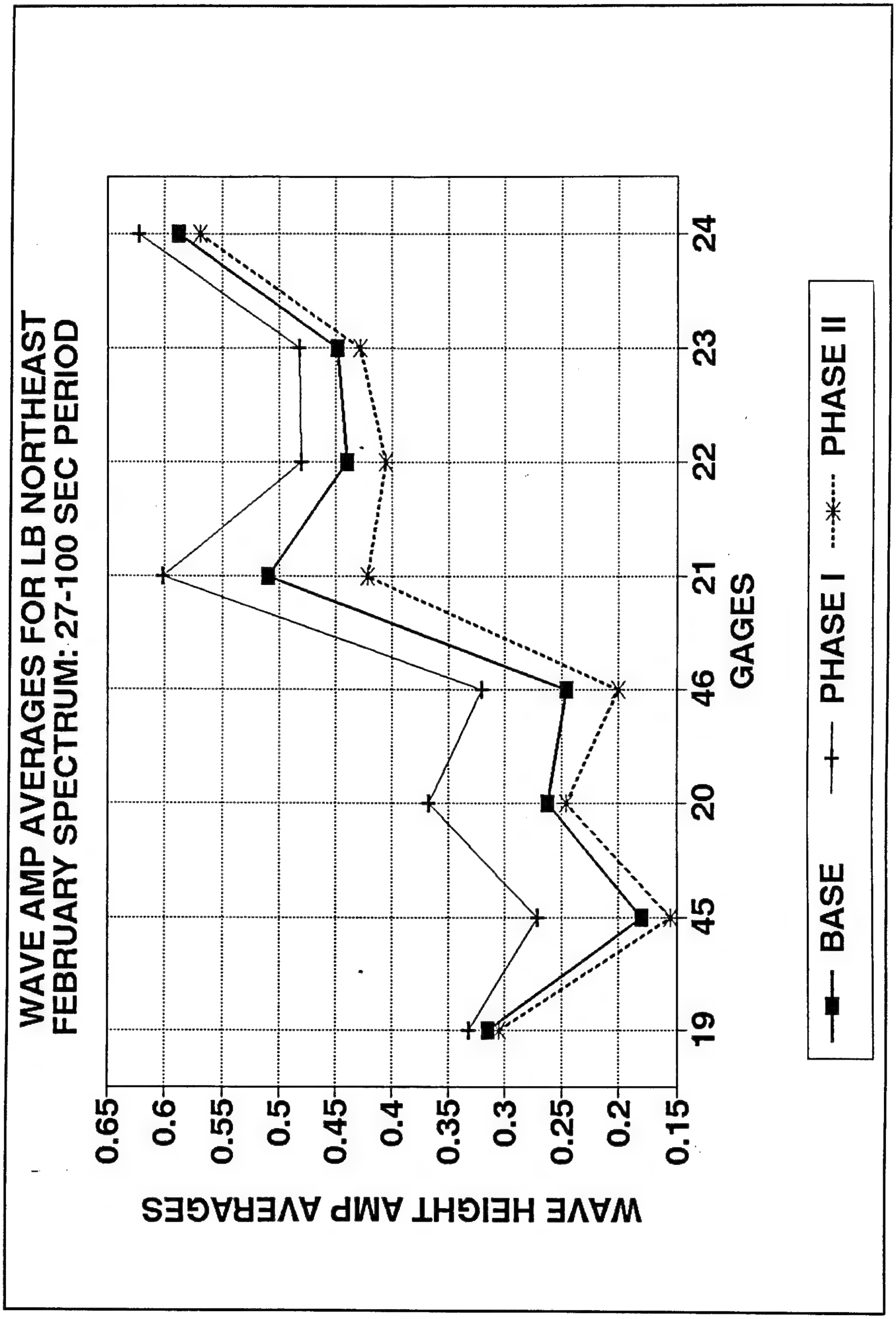

WAVE AMP AVERAGES FOR LB NORTHEAST
FEBRUARY SPECTRUM: 27-100 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
19
45
20
46
21
22
23
24
GAGES
BASE
PHASE I
PHASE II

Plate 39

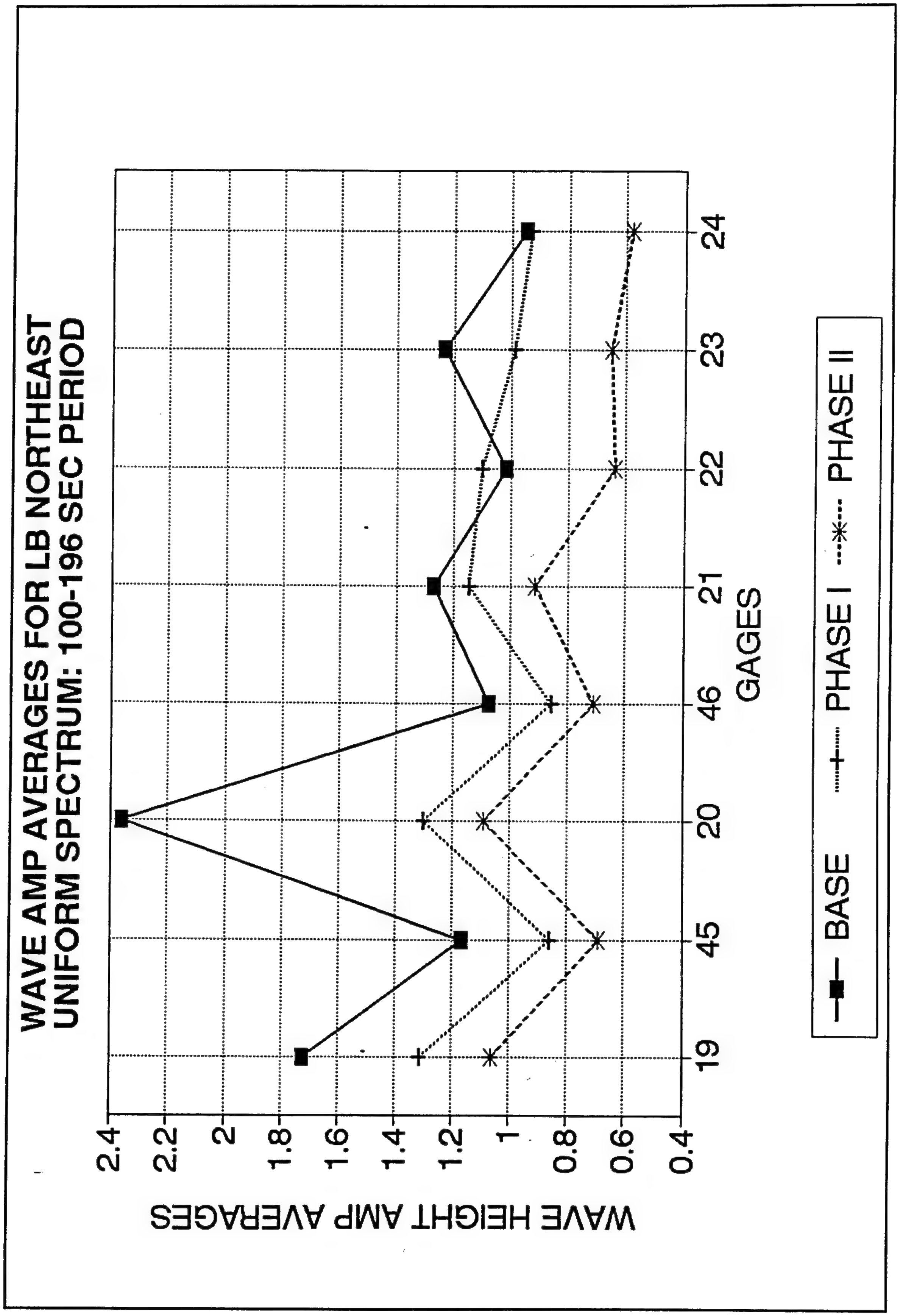
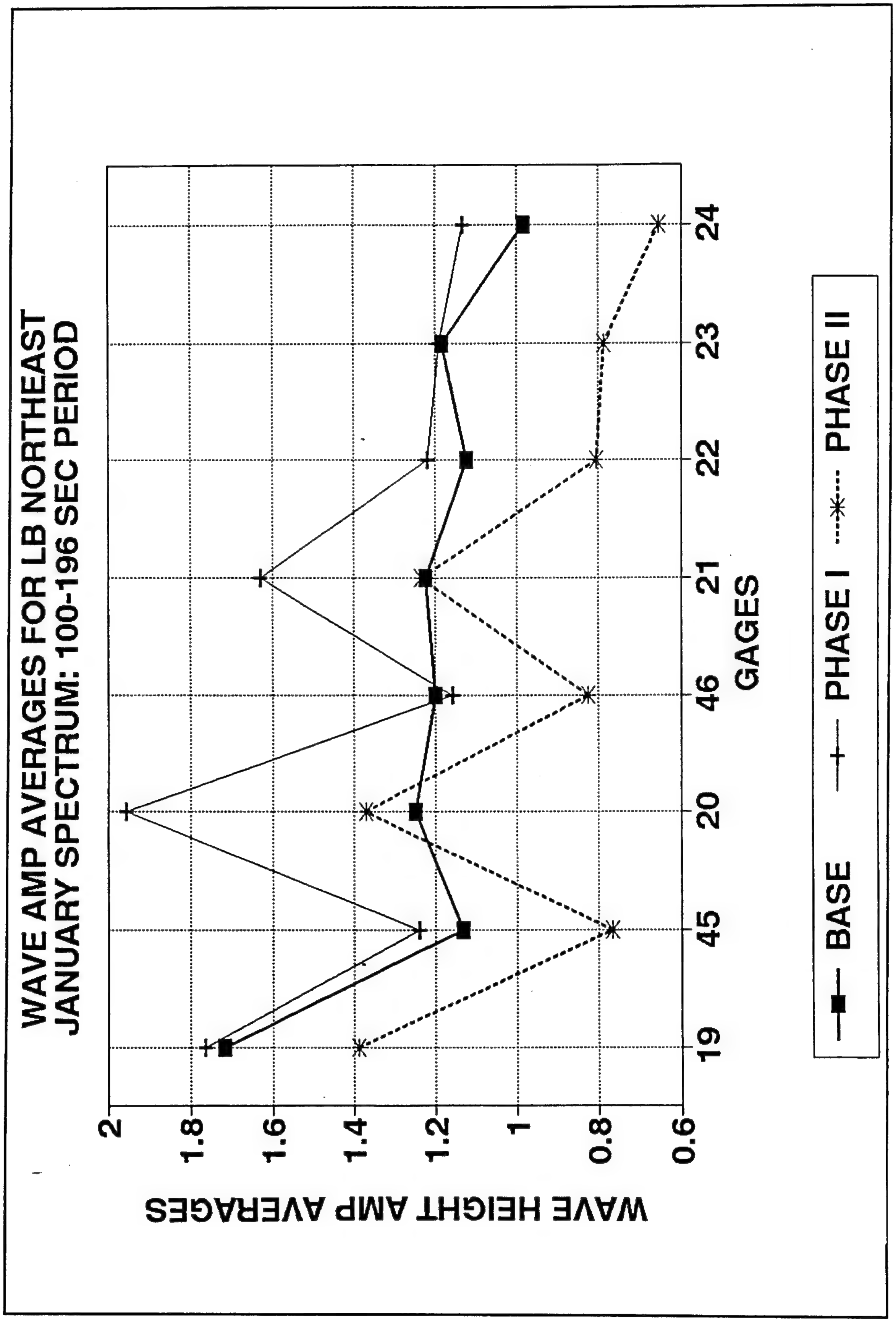

WAVE AMP AVERAGES FOR LB NORTHEAST
UNIFORM SPECTRUM: 100-196 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
19
45
20
46
21
22
23
24
GAGES
BASE
PHASE I
PHASE II

Plate 40



WAVE AMP AVERAGES FOR LB NORTHEAST
JANUARY SPECTRUM: 100-196 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
2
1.8
1.6
1.4
1.2
1
0.8
0.6
GAGES
19
45
20
46
21
22
23
24
BASE
PHASE I
PHASE II

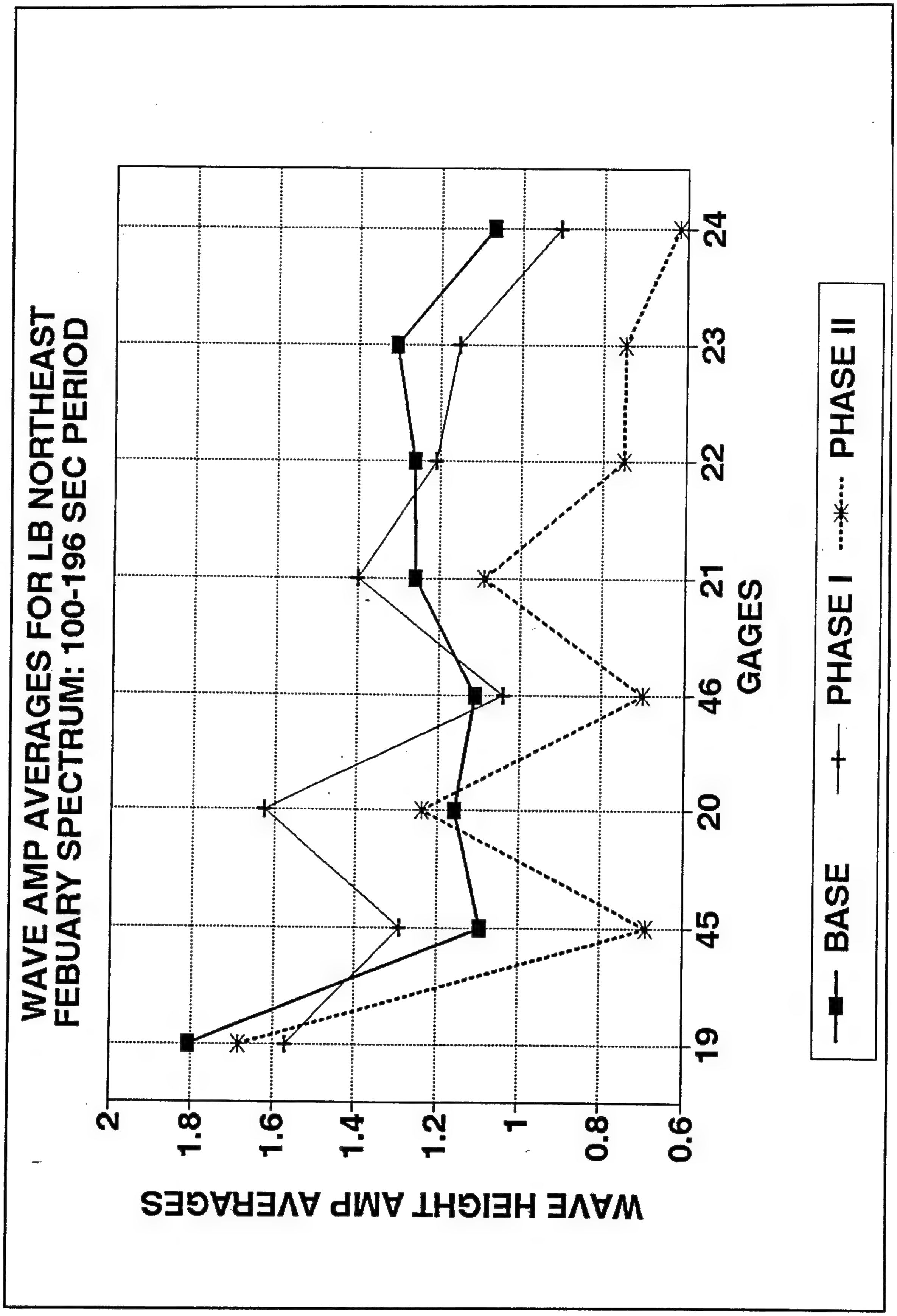
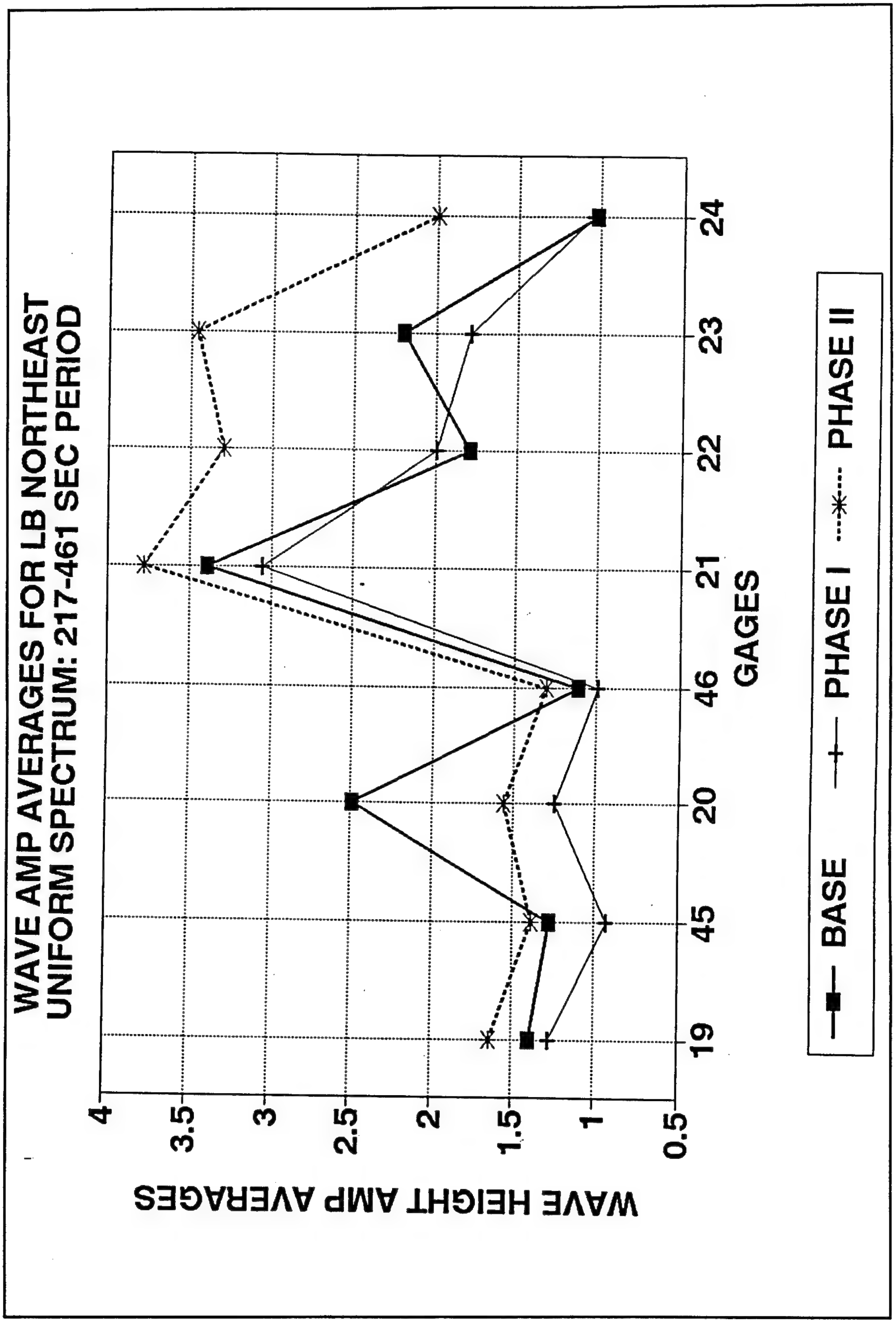

WAVE AMP AVERAGES FOR LB NORTHEAST
FEBUARY SPECTRUM: 100-196 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
2
1.8
1.6
1.4
1.2
1
0.8
0.6
19
45
20
46
21
22
23
24
GAGES
BASE
PHASE I
PHASE II

Plate 42


WAVE AMP AVERAGES FOR LB NORTHEAST
UNIFORM SPECTRUM: 217-461 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
4
3.5
3
2.5
2
1.5
1
0.5
19
45
20
46
21
22
23
24
GAGES
BASE
PHASE I
PHASE II

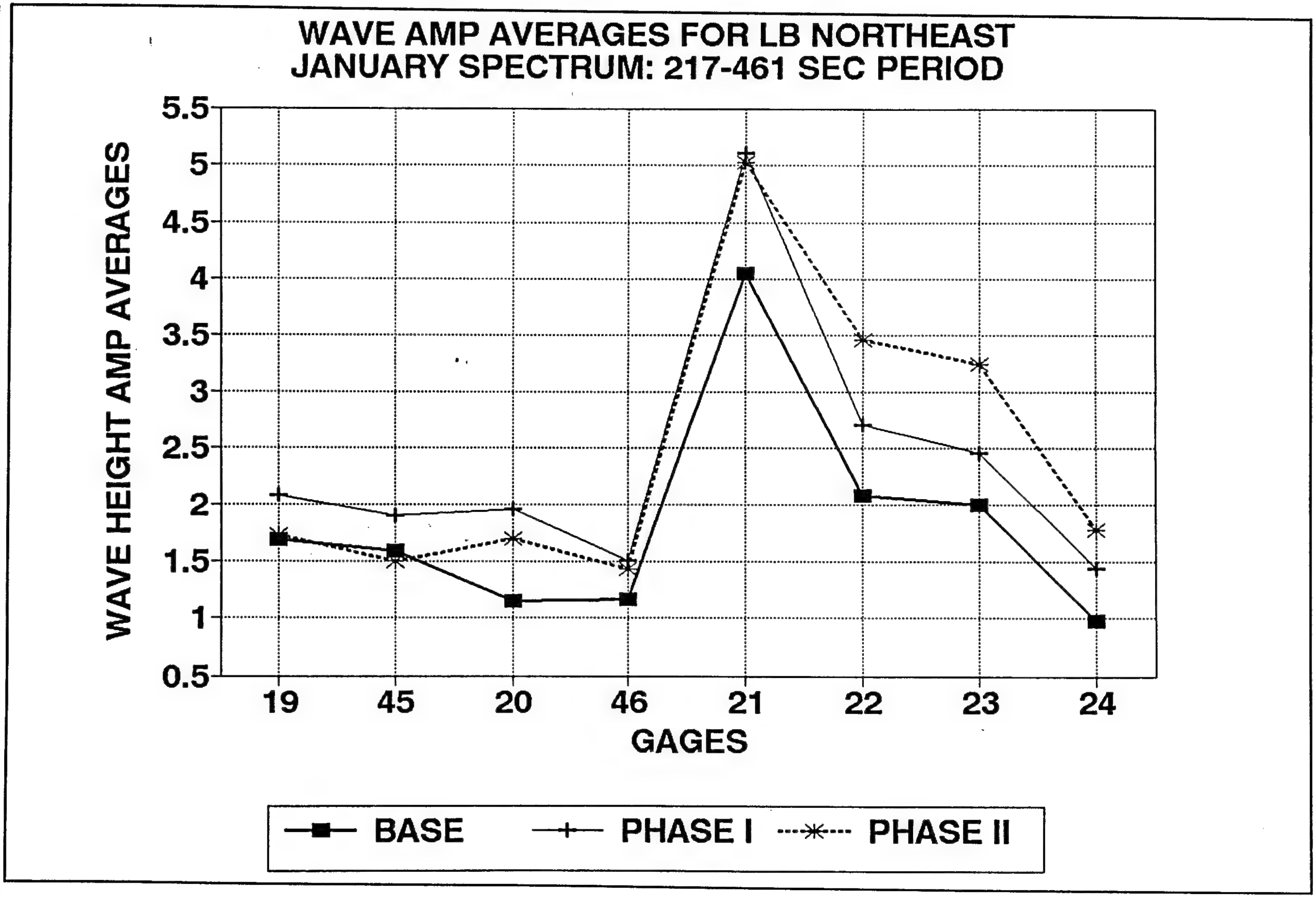
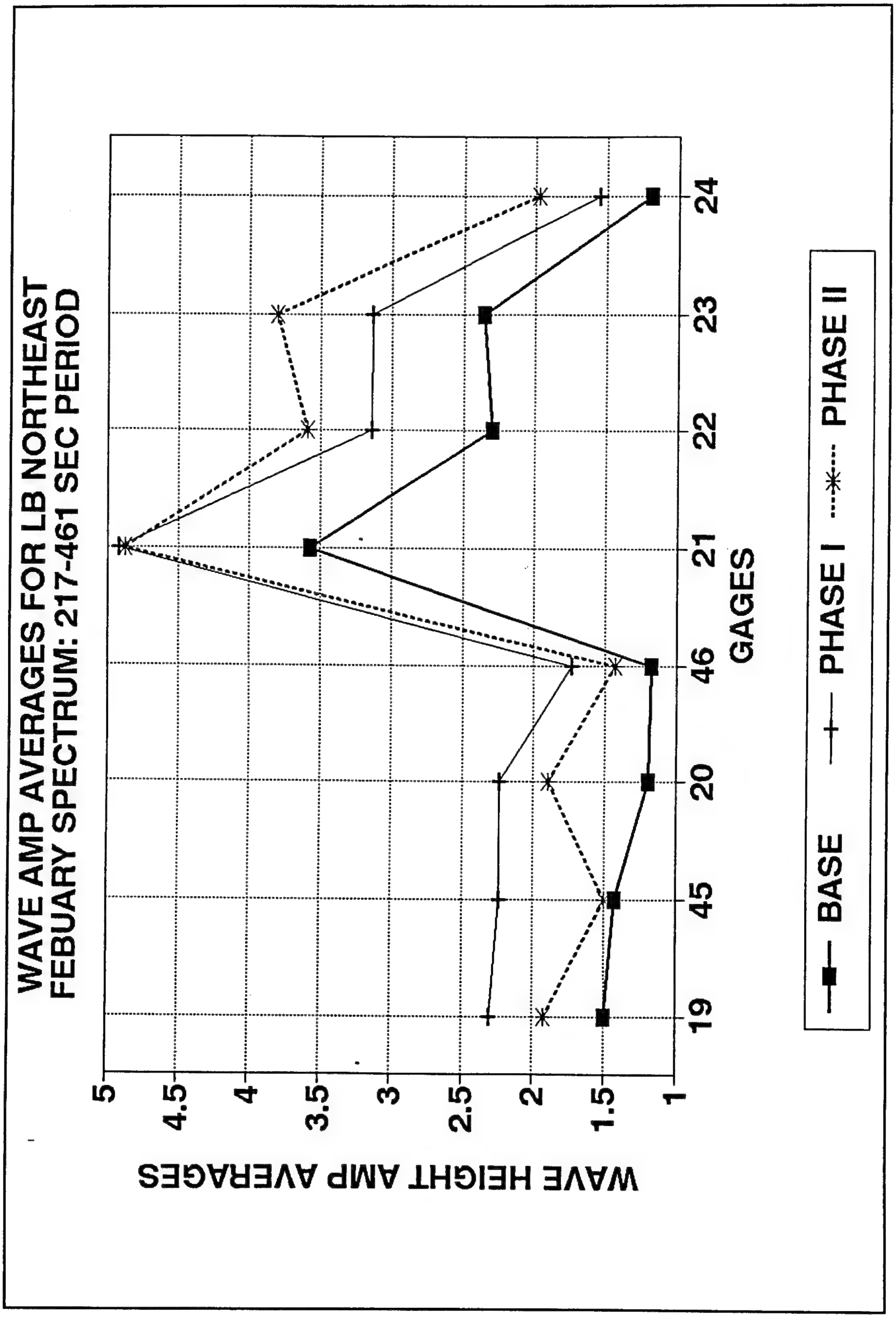

WAVE AMP AVERAGES FOR LB NORTHEAST
JANUARY SPECTRUM: 217-461 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
19
45
20
46
21
22
23
24
GAGES
BASE
PHASE I
PHASE II

Plate 44


WAVE AMP AVERAGES FOR LB NORTHEAST
FEBUARY SPECTRUM: 217-461 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
5
4.5
4
3.5
3
2.5
2
1.5
1
GAGES
19
45
20
46
21
22
23
24
BASE
PHASE I
PHASE II

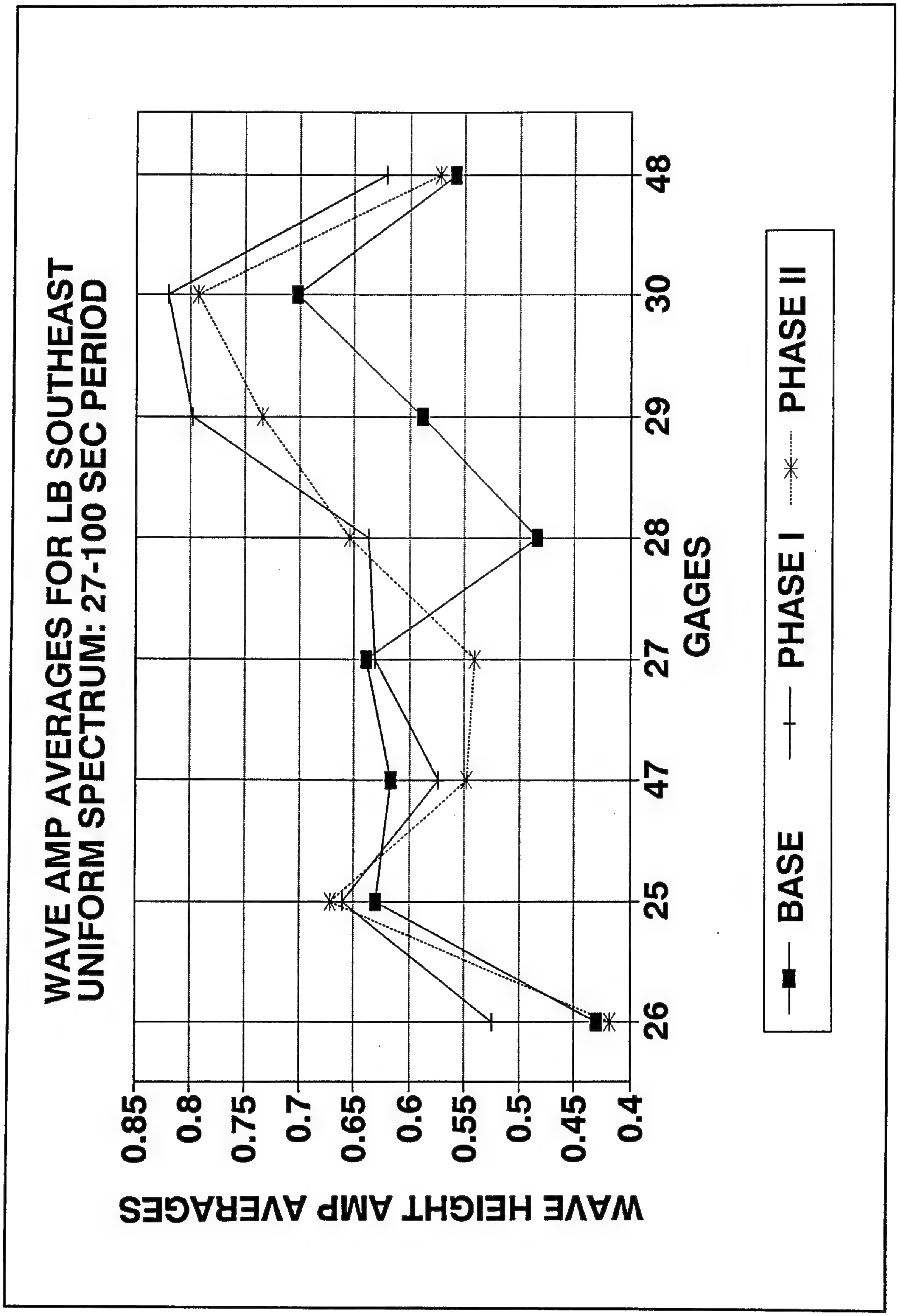

WAVE AMP AVERAGES FOR LB SOUTHEAST
UNIFORM SPECTRUM: 27-100 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
0.45
0.4
26
25
47
27
28
29
30
48
GAGES
BASE
PHASE I
PHASE II

Plate 46

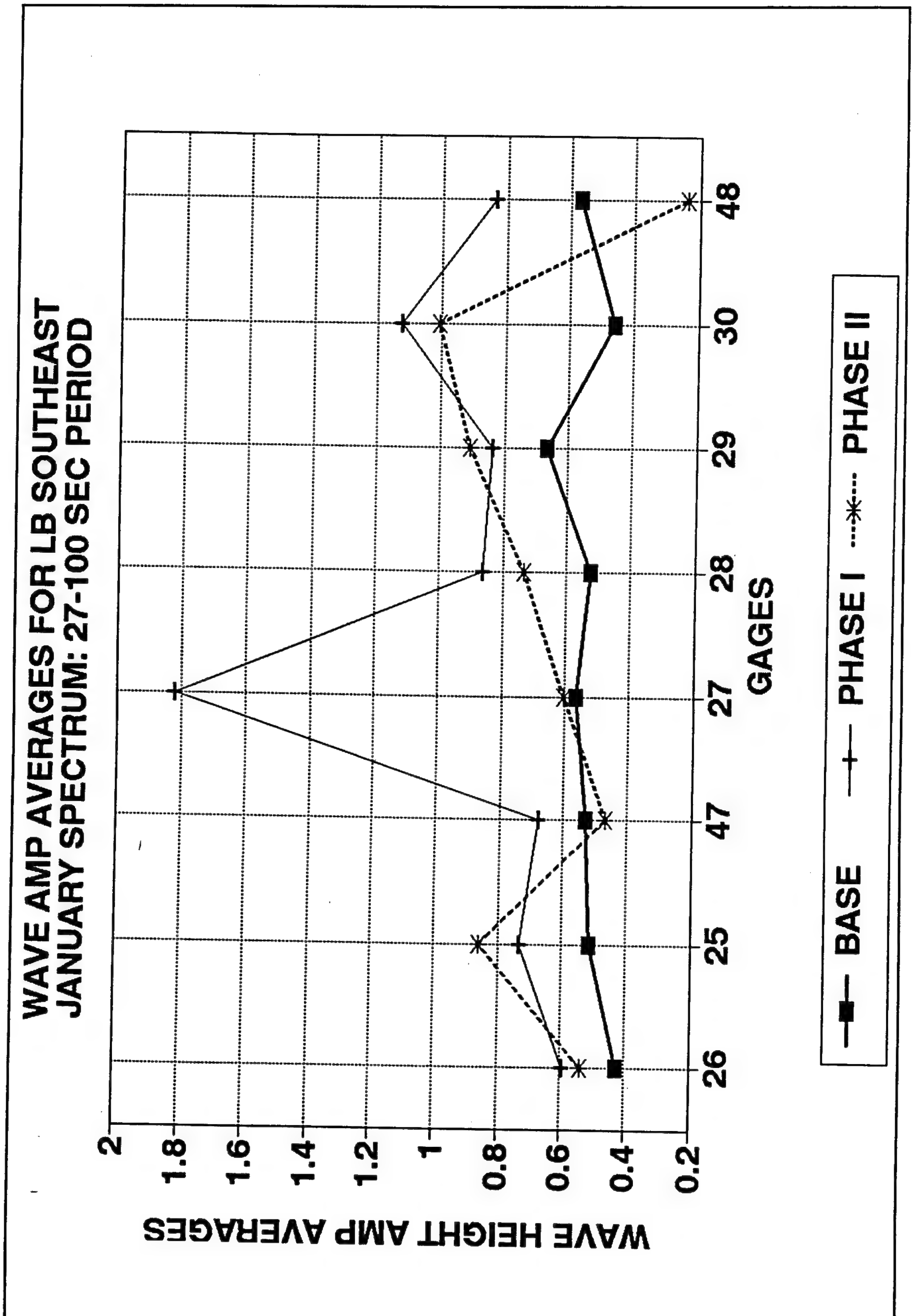

WAVE AMP AVERAGES FOR LB SOUTHEAST
JANUARY SPECTRUM: 27-100 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
26
25
47
27
28
29
30
48
GAGES
BASE
PHASE I
PHASE II

Plate 47

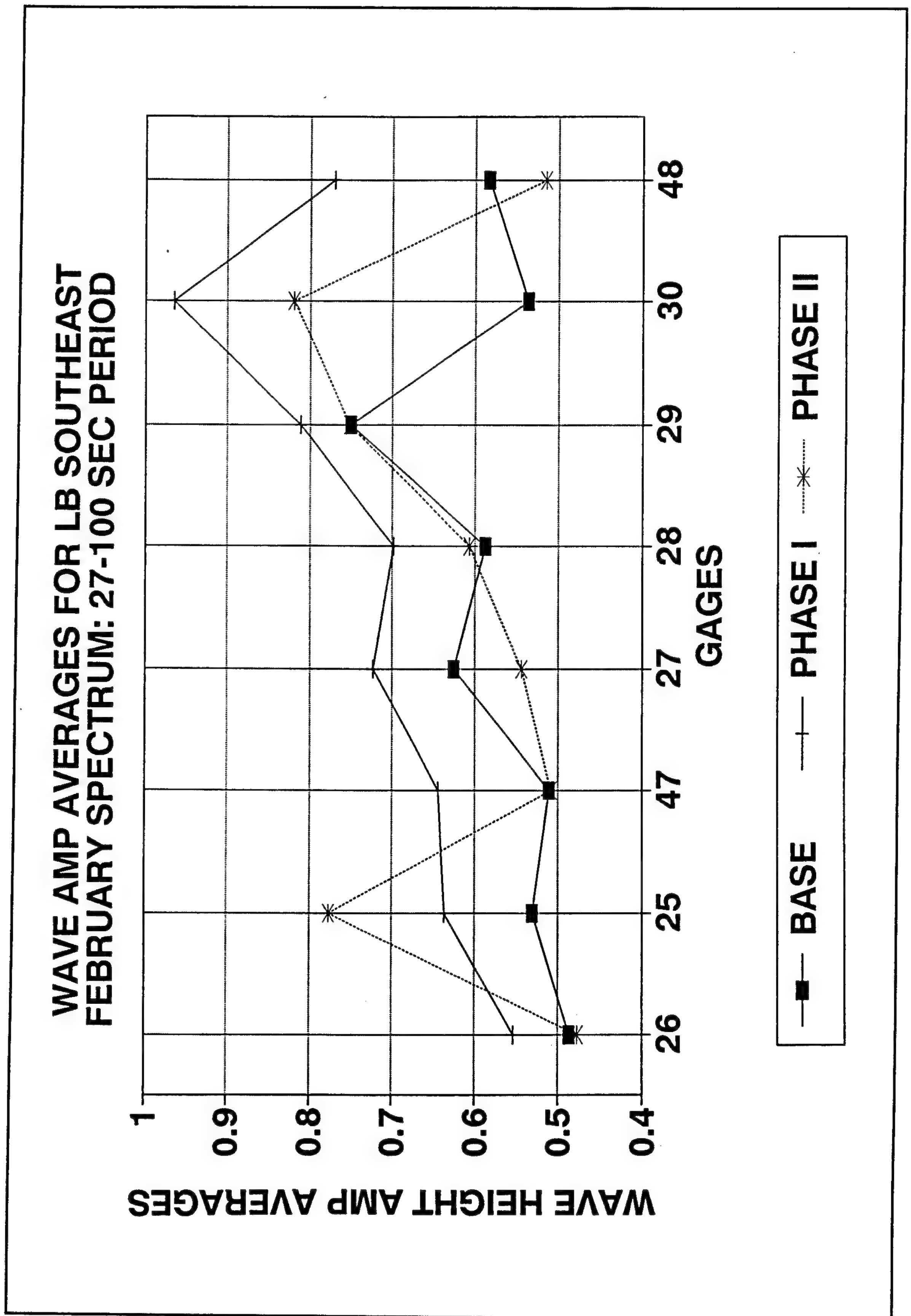
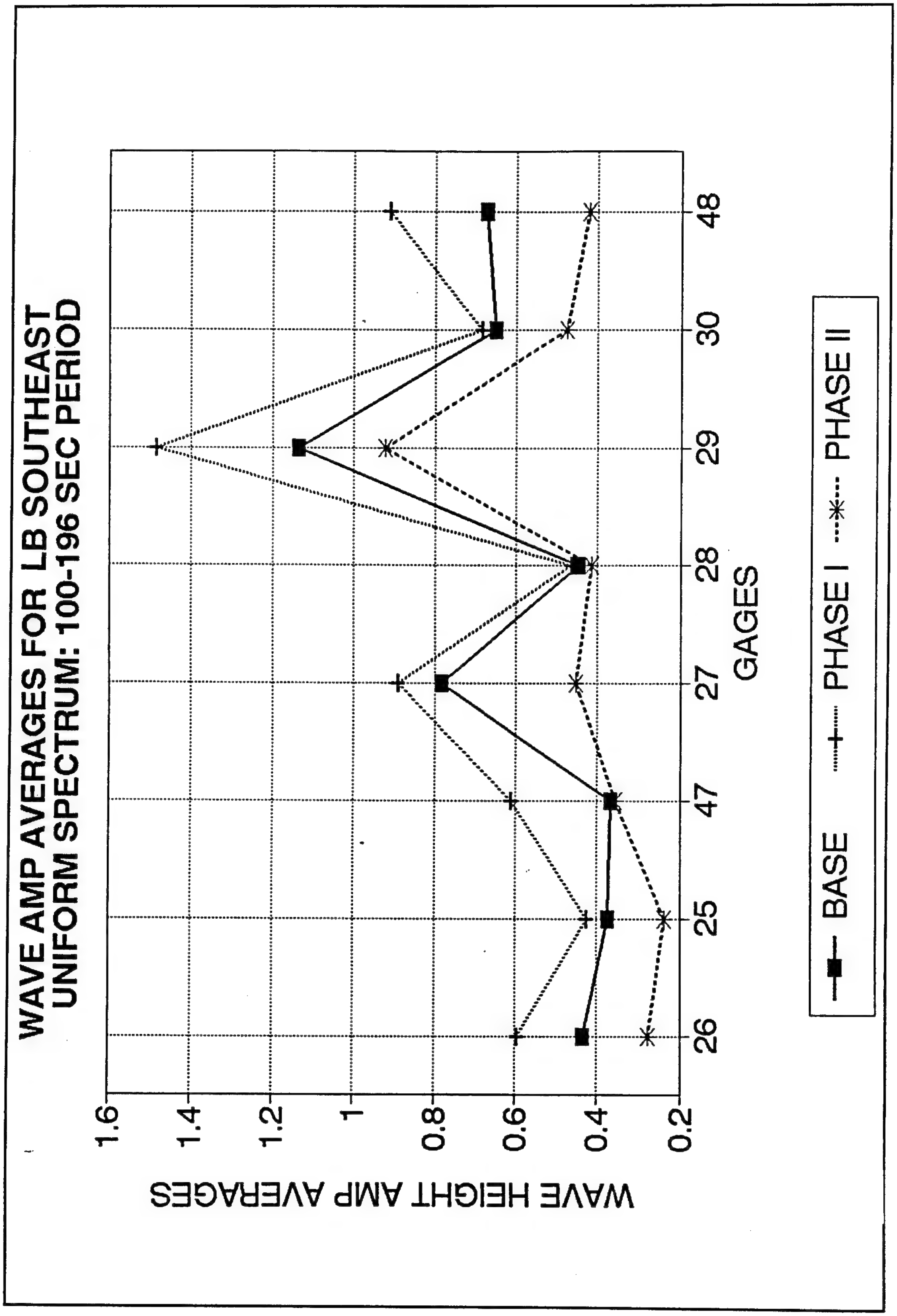
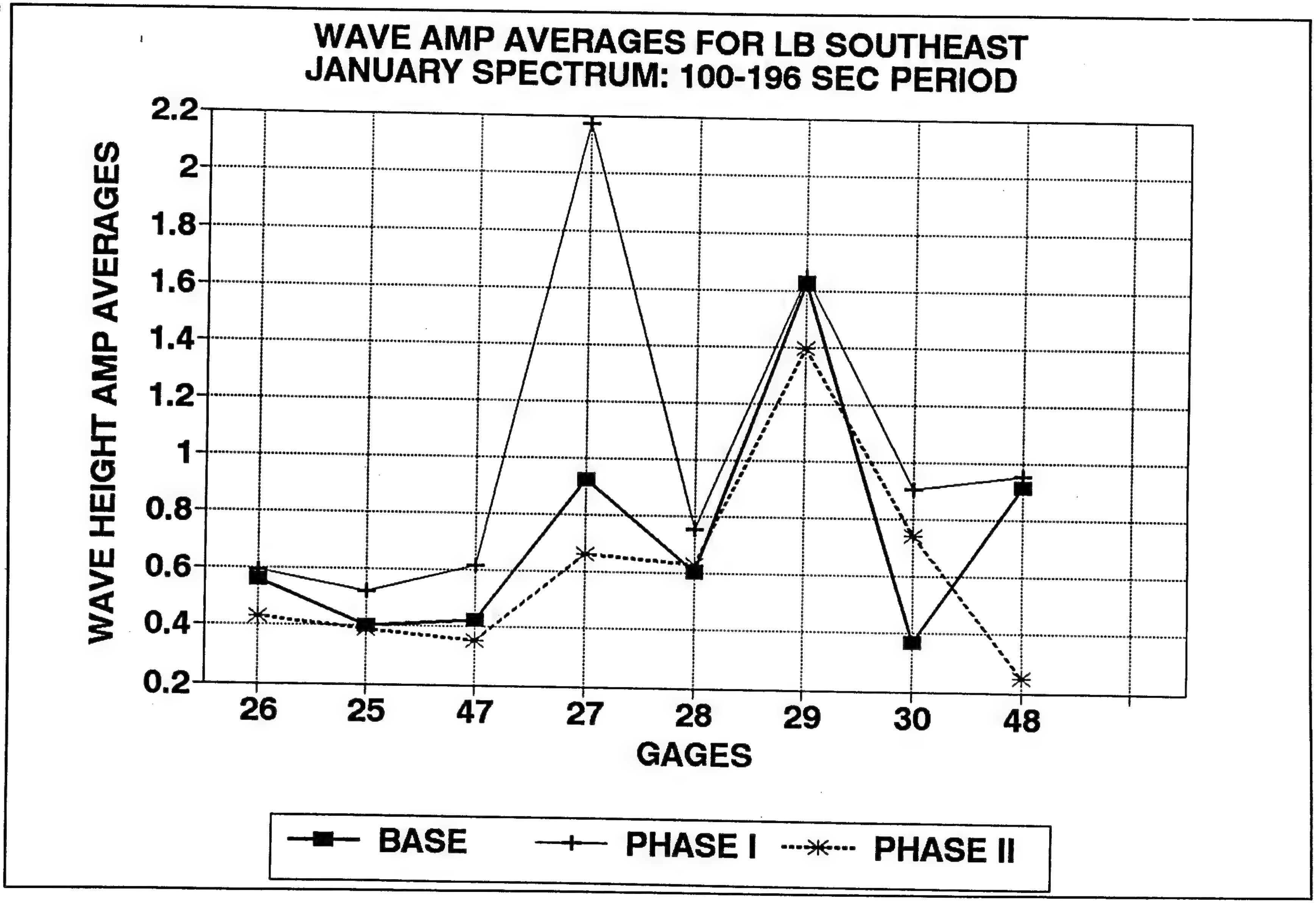

WAVE AMP AVERAGES FOR LB SOUTHEAST
FEBRUARY SPECTRUM: 27-100 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
1
0.9
0.8
0.7
0.6
0.5
0.4
26
25
47
27
28
29
30
48
GAGES
BASE
PHASE I
PHASE II

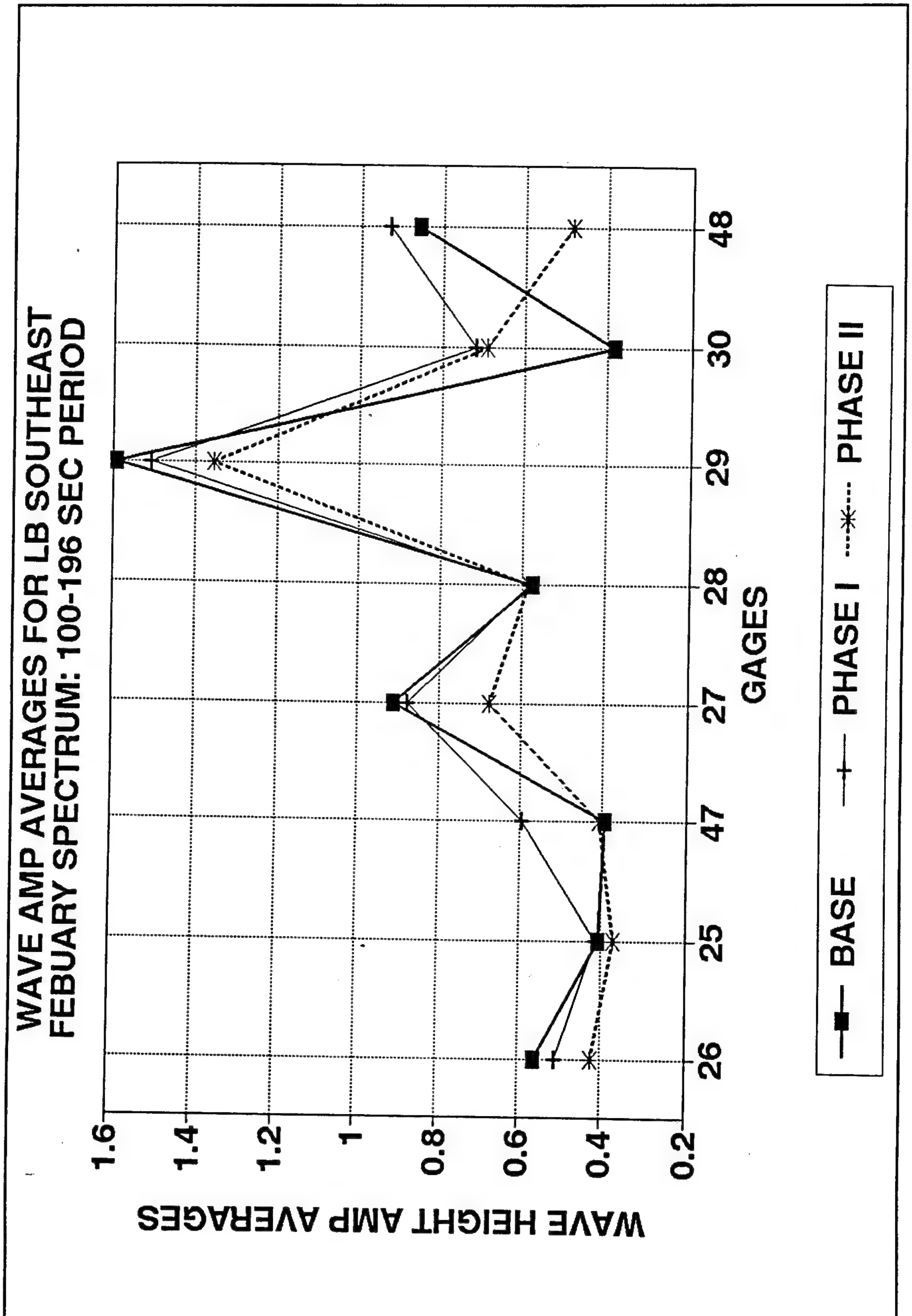
Plate 48


WAVE AMP AVERAGES FOR LB SOUTHEAST
UNIFORM SPECTRUM: 100-196 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
26
25
47
27
28
29
30
48
GAGES
BASE
PHASE I
PHASE II



WAVE AMP AVERAGES FOR LB SOUTHEAST
JANUARY SPECTRUM: 100-196 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
26
25
47
27
28
29
30
48
GAGES
BASE
PHASE I
PHASE II


Plate 50


WAVE AMP AVERAGES FOR LB SOUTHEAST
FEBUARY SPECTRUM: 100-196 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
26
25
47
27
28
29
30
48
GAGES
BASE
PHASE I
PHASE II

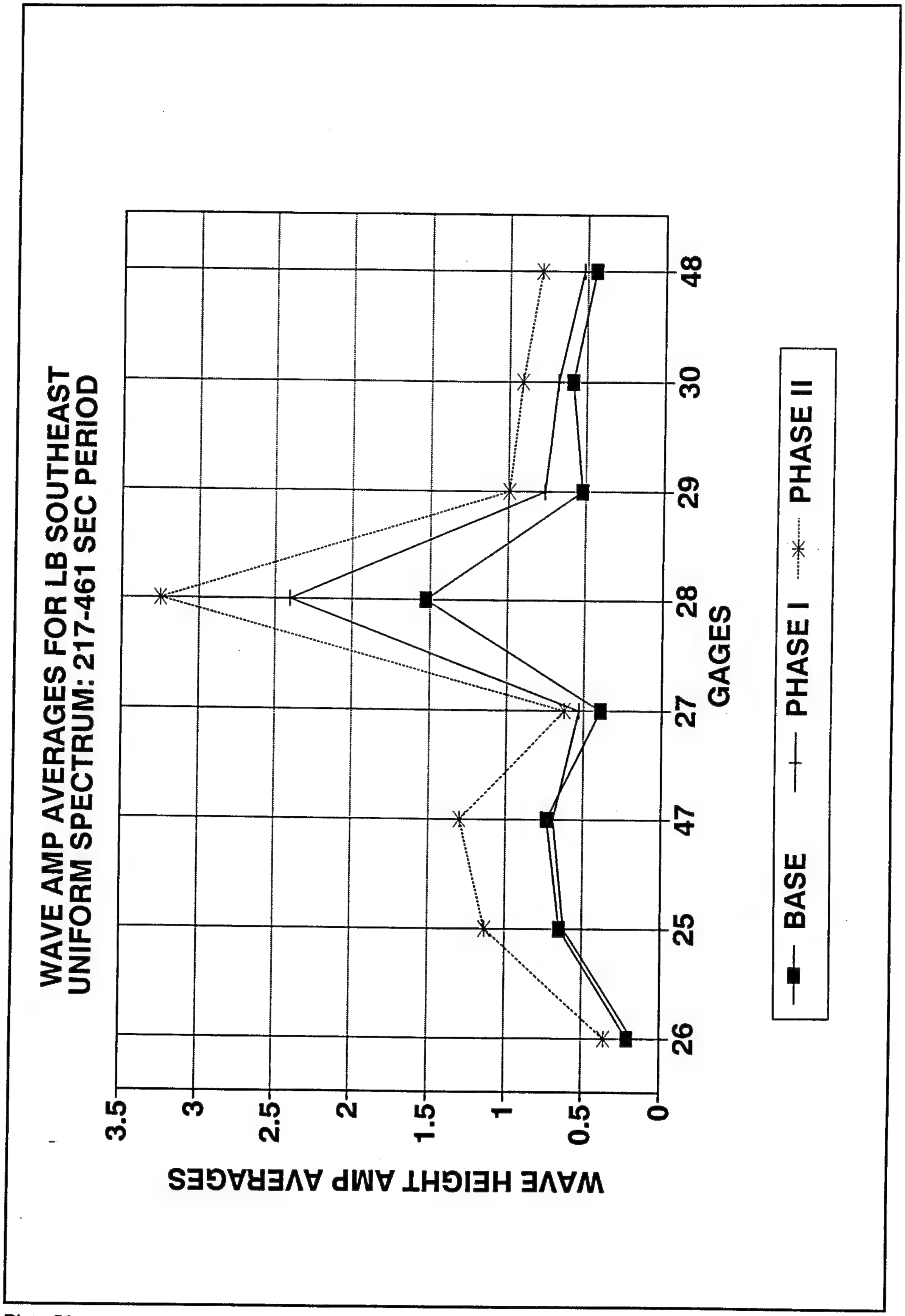
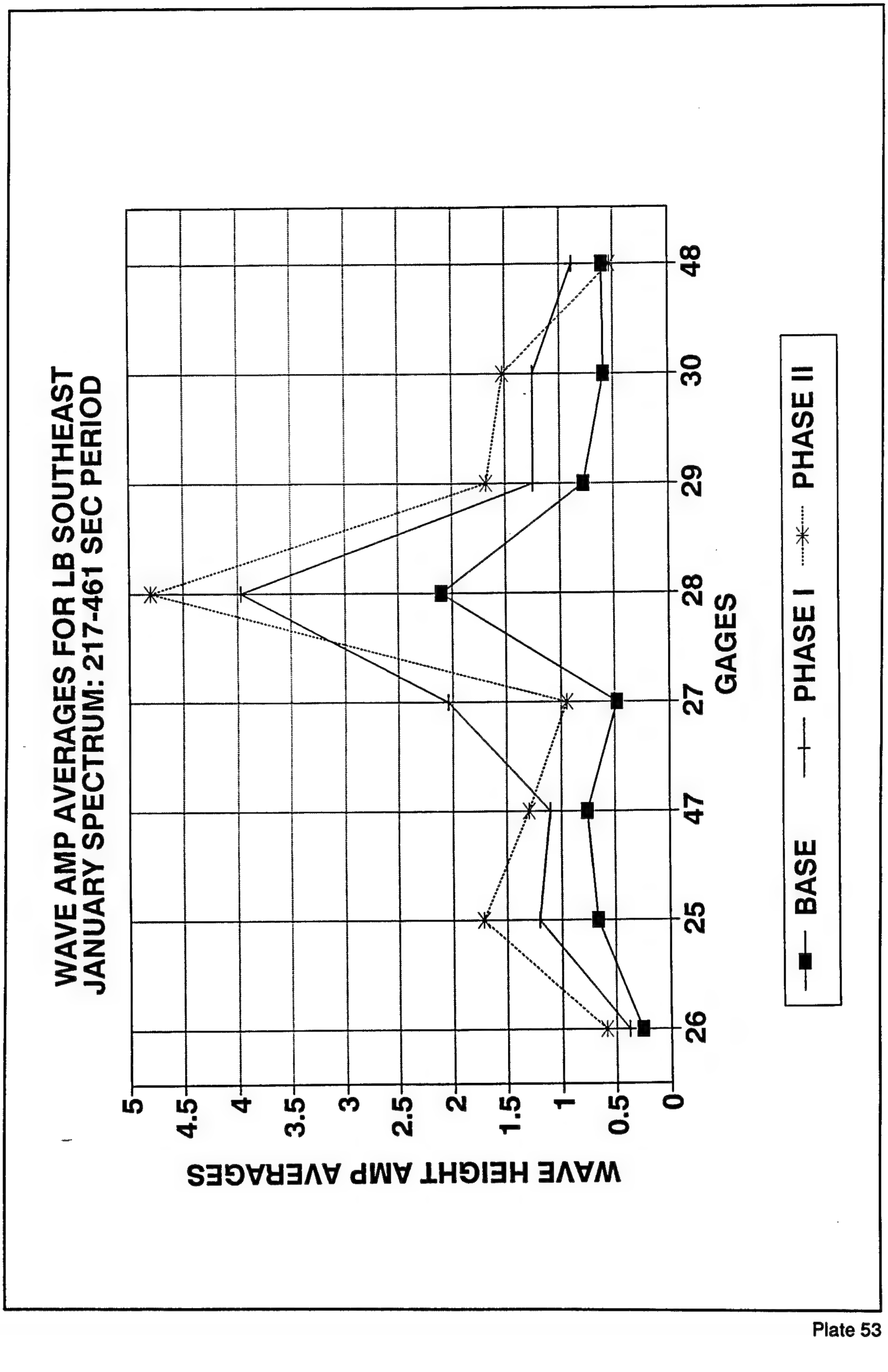
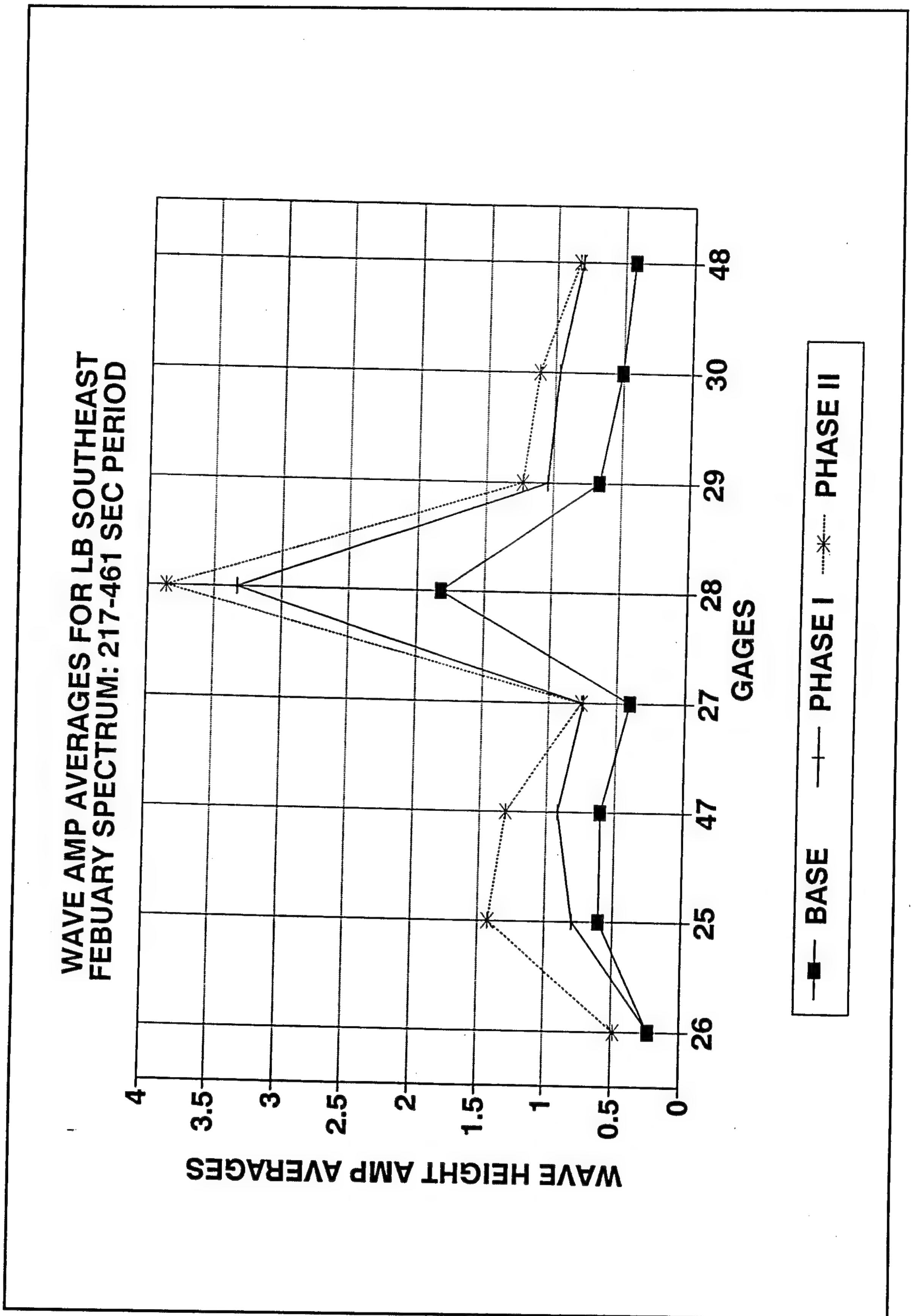
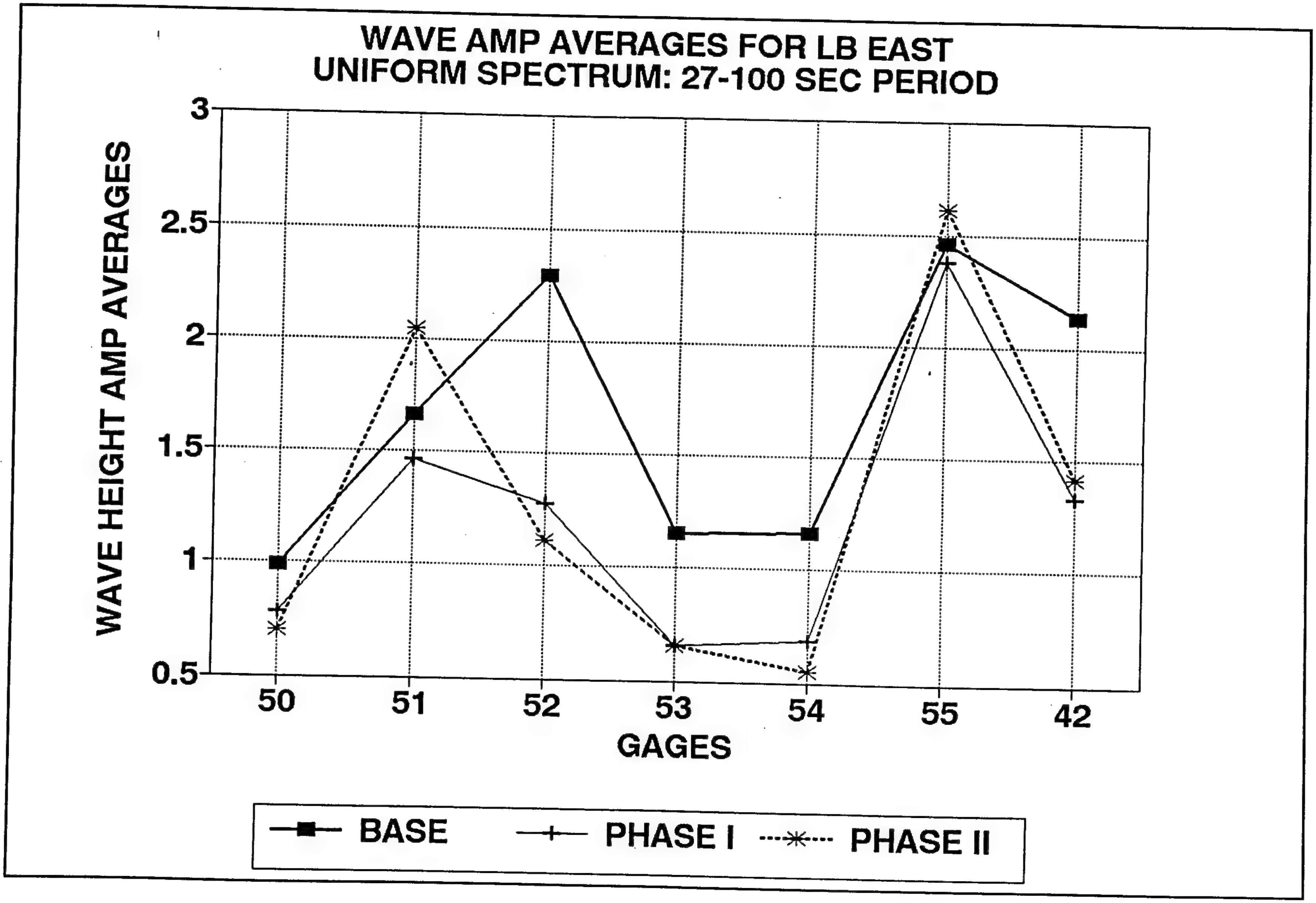

WAVE AMP AVERAGES FOR LB SOUTHEAST
UNIFORM SPECTRUM: 217-461 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
3.5
3
2.5
2
1.5
1
0.5
0
26
25
47
27
28
29
30
48
GAGES
BASE
PHASE I
PHASE II

Plate 52


WAVE AMP AVERAGES FOR LB SOUTHEAST
JANUARY SPECTRUM: 217-461 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
26
25
47
27
28
29
30
48
GAGES
BASE
PHASE I
PHASE II


WAVE AMP AVERAGES FOR LB SOUTHEAST
FEBUARY SPECTRUM: 217-461 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
4
3.5
3
2.5
2
1.5
1
0.5
0
26
25
47
27
28
29
30
48
GAGES
BASE
PHASE I
PHASE II


WAVE AMP AVERAGES FOR LB EAST
UNIFORM SPECTRUM: 27-100 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
3
2.5
2
1.5
1
0.5
50
51
52
53
54
55
42
GAGES
BASE
PHASE I
PHASE II

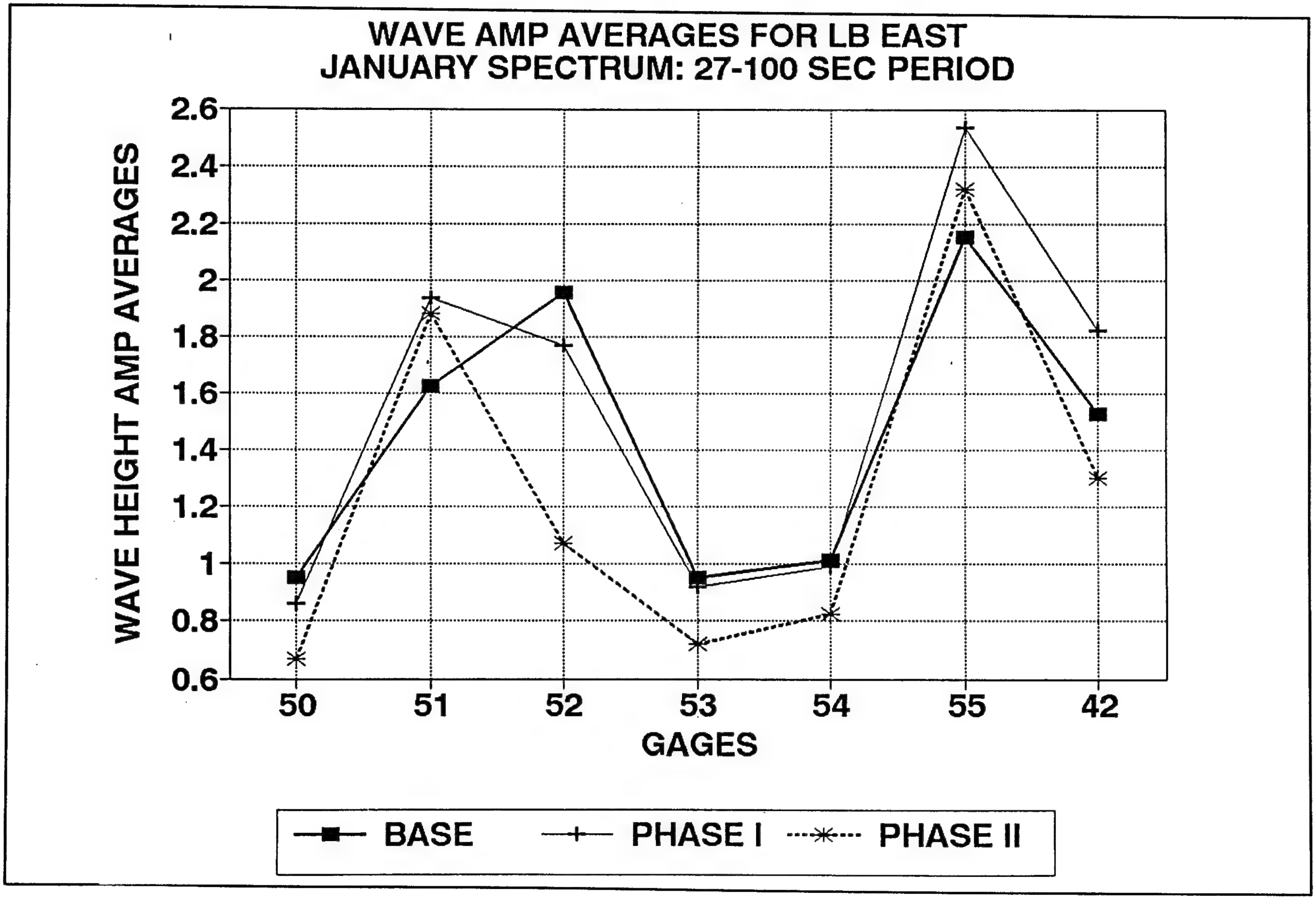
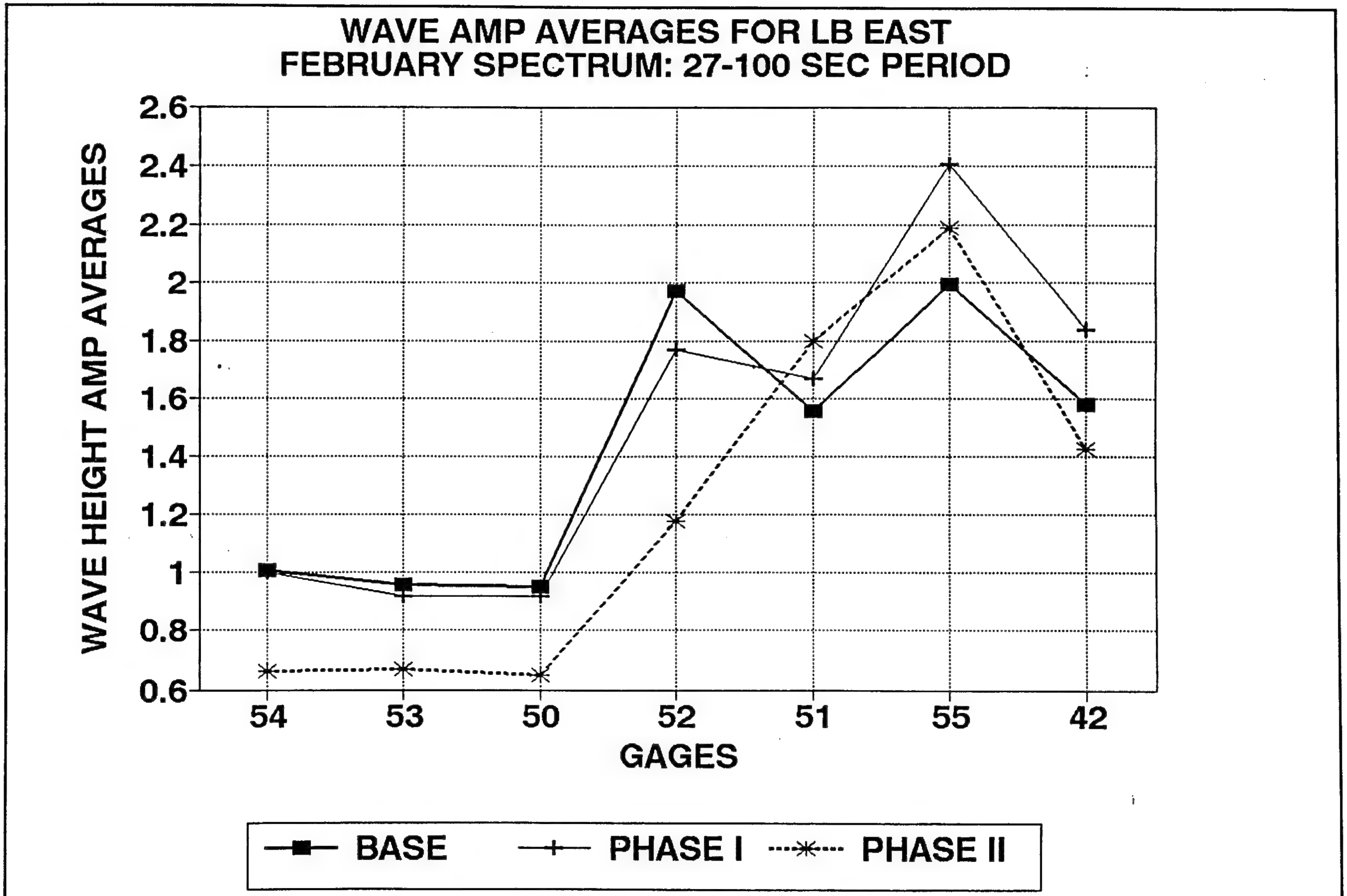

WAVE AMP AVERAGES FOR LB EAST
JANUARY SPECTRUM: 27-100 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
50
51
52
53
54
55
42
GAGES
BASE
PHASE I
PHASE II

Plate 56


WAVE AMP AVERAGES FOR LB EAST
FEBRUARY SPECTRUM: 27-100 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
54
53
50
52
51
55
42
GAGES
BASE
PHASE I
PHASE II

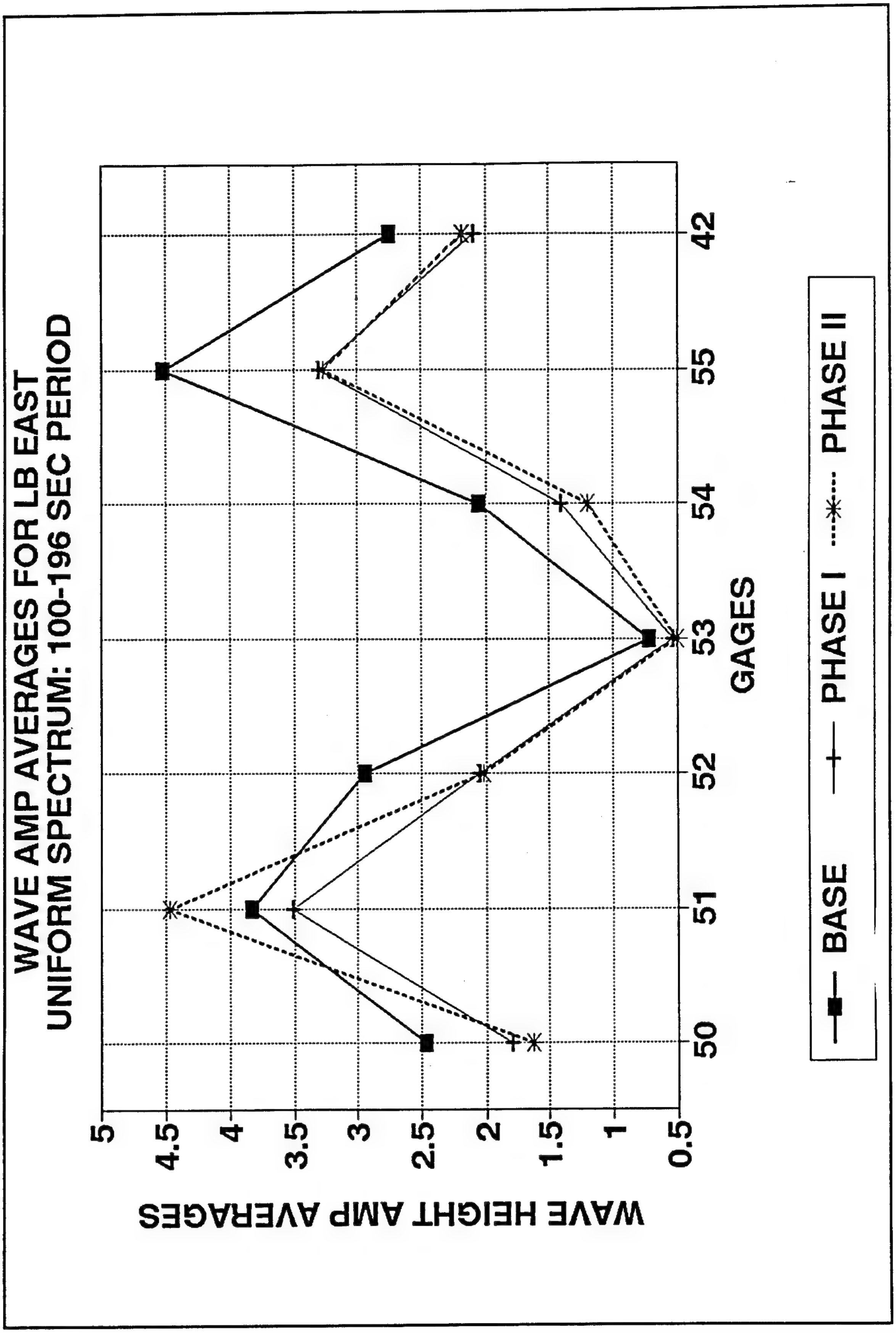
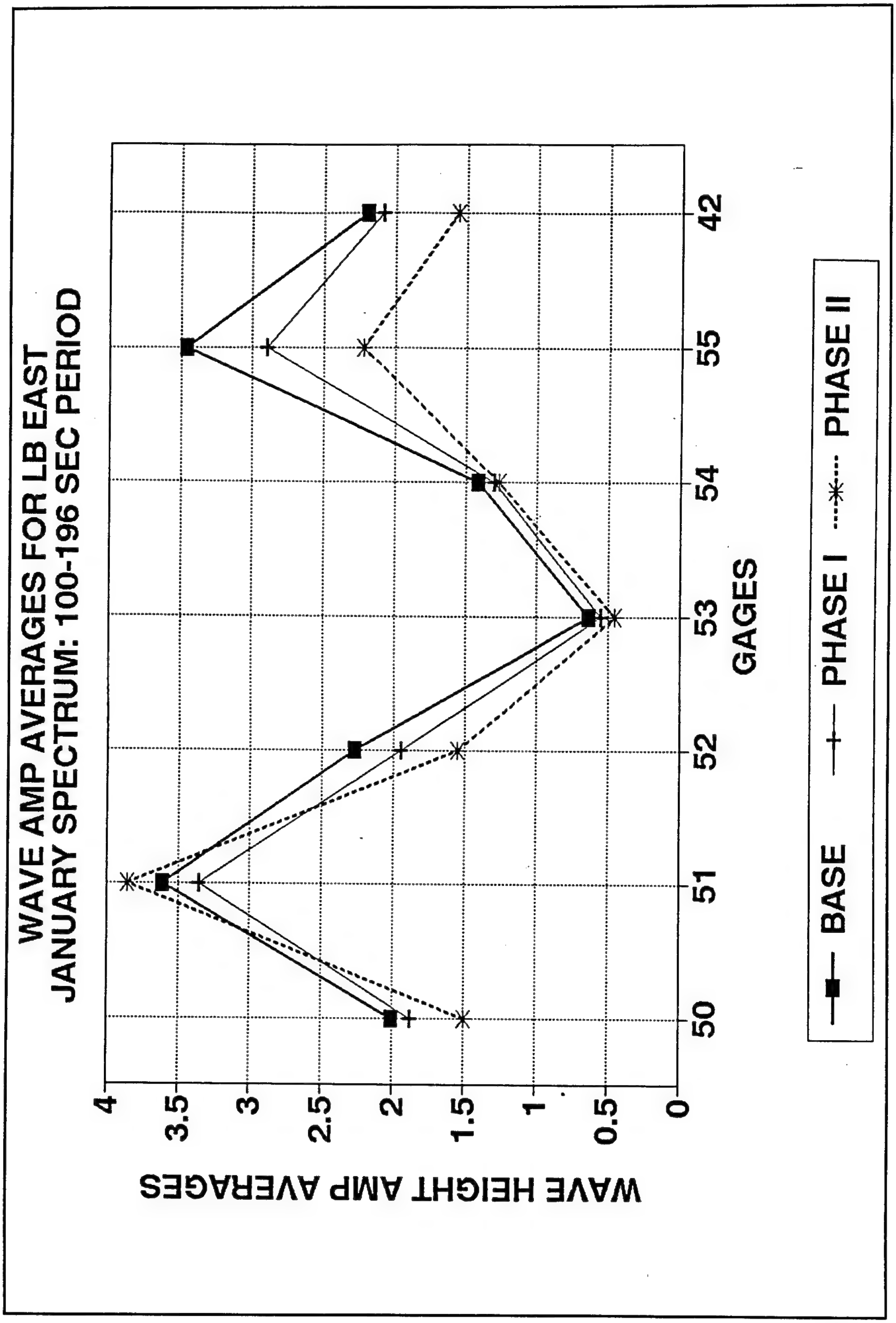

WAVE AMP AVERAGES FOR LB EAST
UNIFORM SPECTRUM: 100-196 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
50
51
52
53
54
55
42
GAGES
BASE
PHASE I
PHASE II

Plate 58


WAVE AMP AVERAGES FOR LB EAST
JANUARY SPECTRUM: 100-196 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
4
3.5
3
2.5
2
1.5
1
0.5
0
50
51
52
53
54
55
42
GAGES
BASE
PHASE I
PHASE II

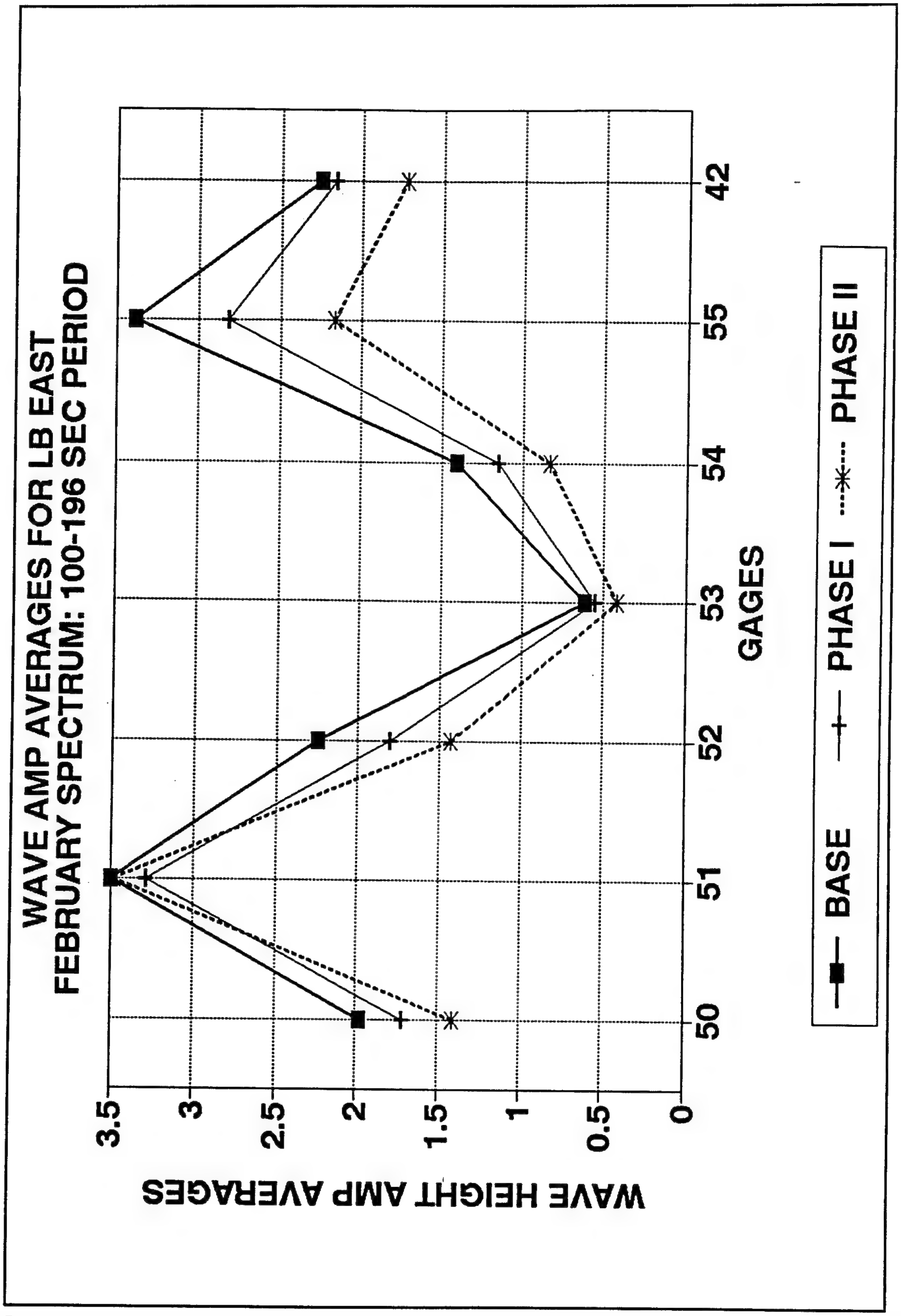
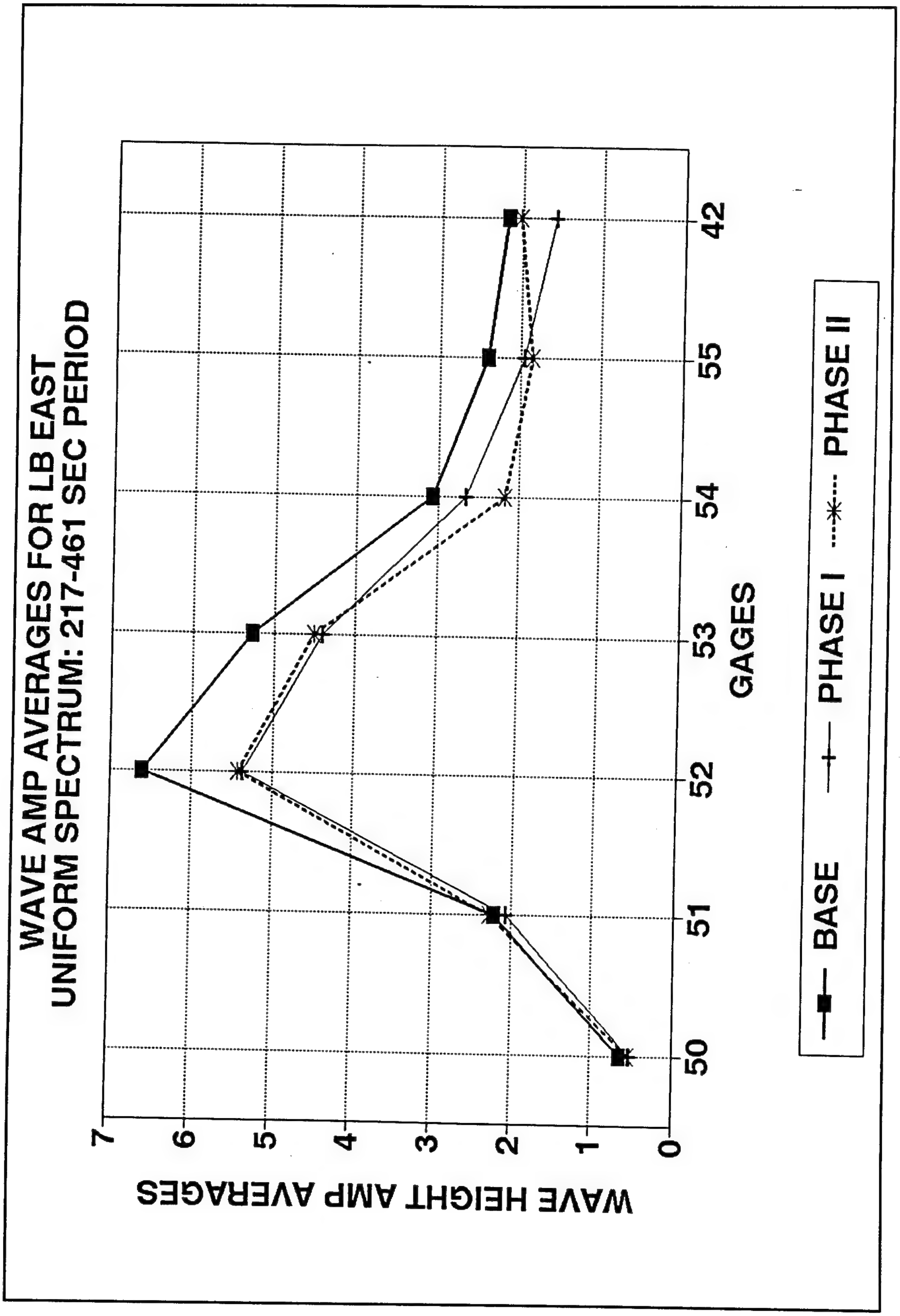

WAVE AMP AVERAGES FOR LB EAST
FEBRUARY SPECTRUM: 100-196 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
3.5
3
2.5
2
1.5
1
0.5
0
50
51
52
53
54
55
42
GAGES
BASE
PHASE I
PHASE II

Plate 60



WAVE AMP AVERAGES FOR LB EAST
UNIFORM SPECTRUM: 217-461 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
0
1
2
3
4
5
6
7
GAGES
50
51
52
53
54
55
42
BASE
PHASE I
PHASE II

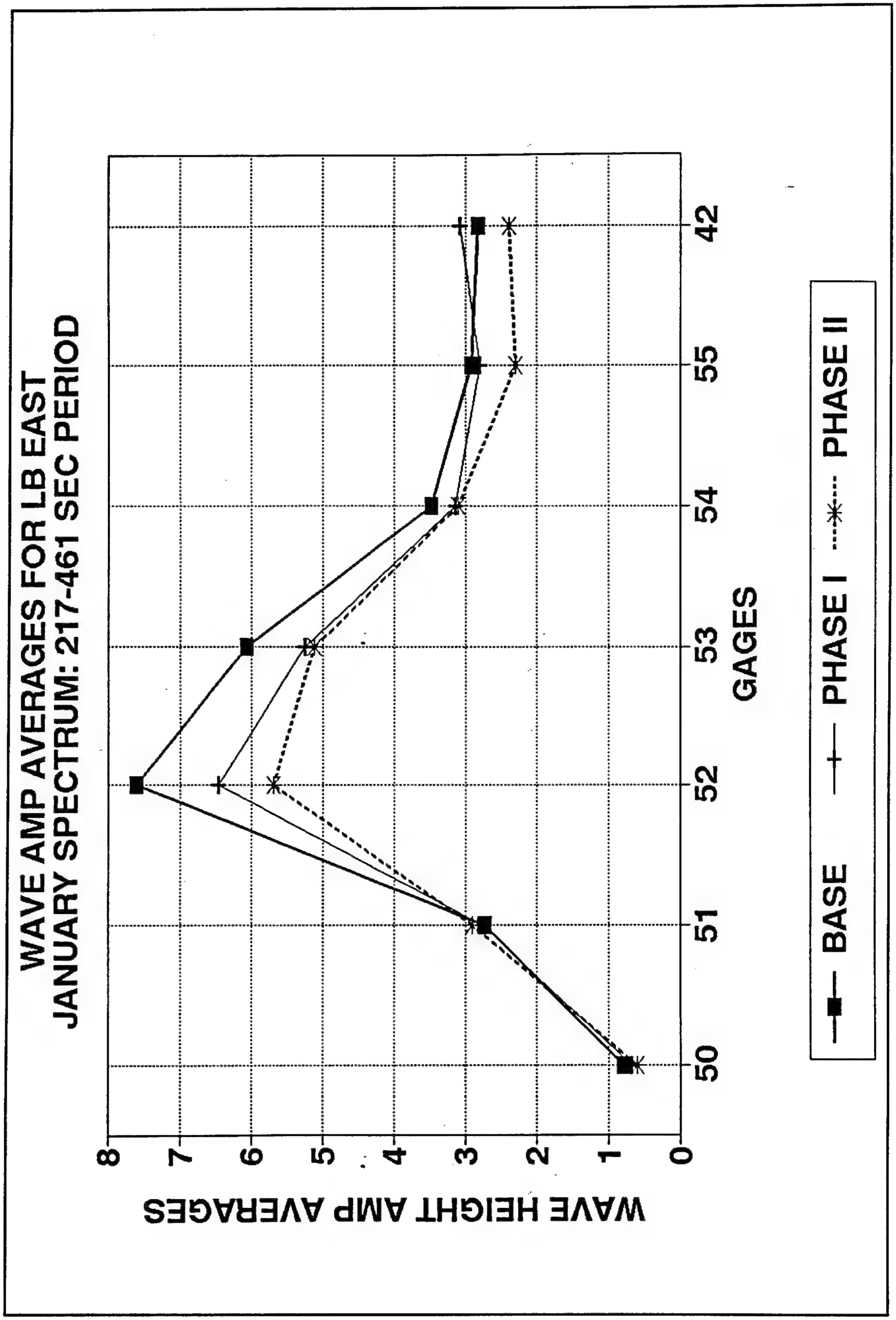
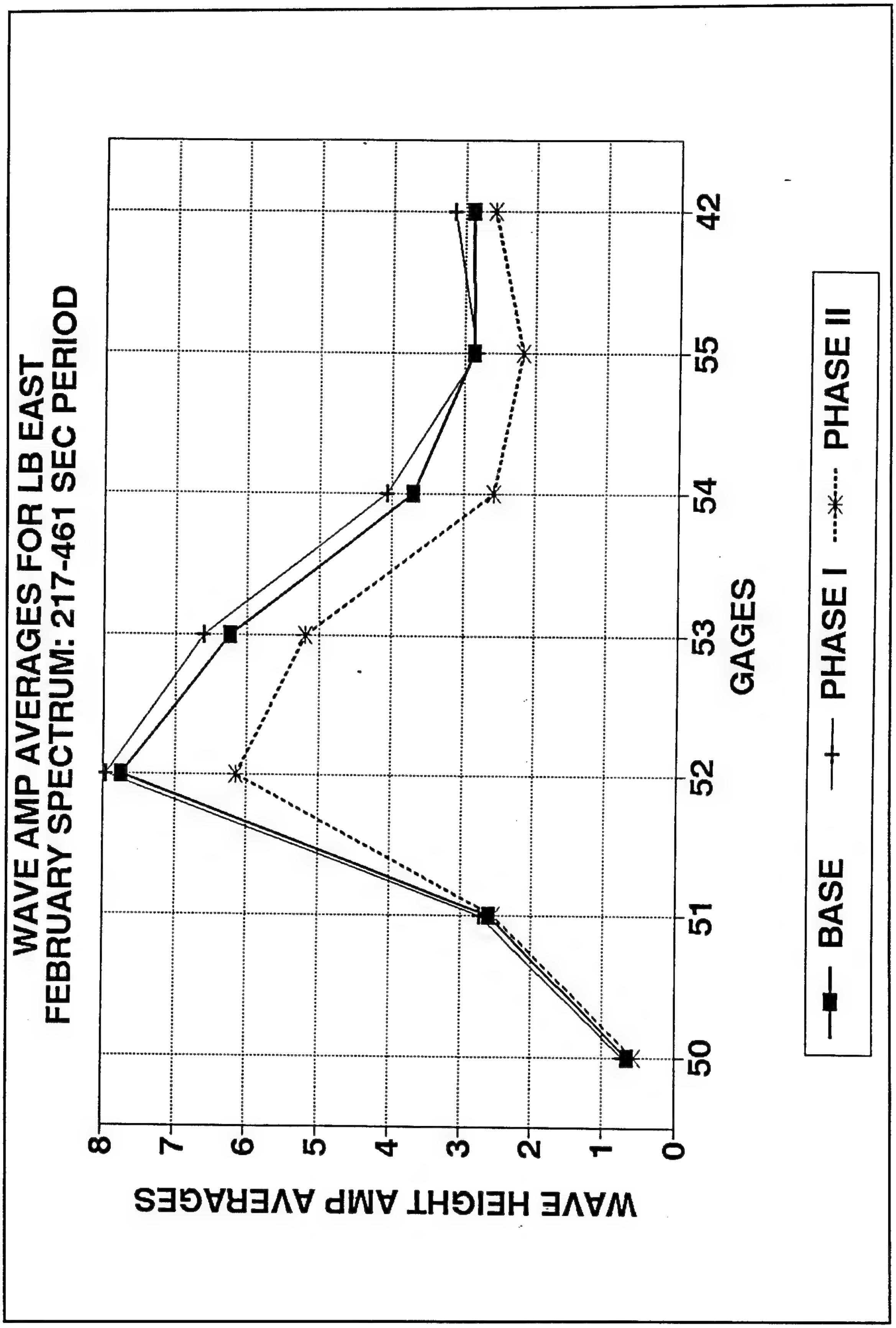
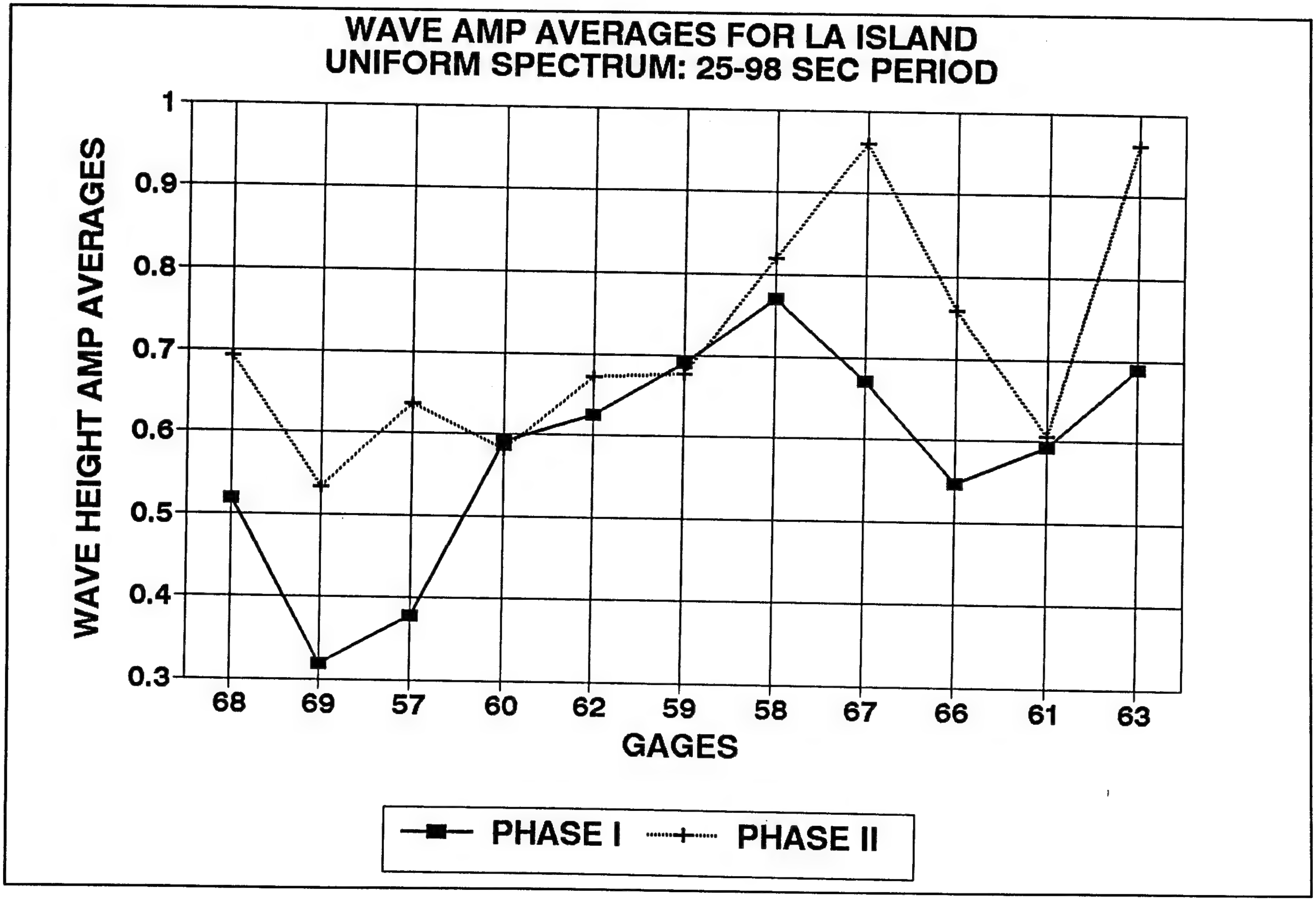

WAVE AMP AVERAGES FOR LB EAST
JANUARY SPECTRUM: 217-461 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
0
1
2
3
4
5
6
7
8
GAGES
50
51
52
53
54
55
42
BASE
PHASE I
PHASE II

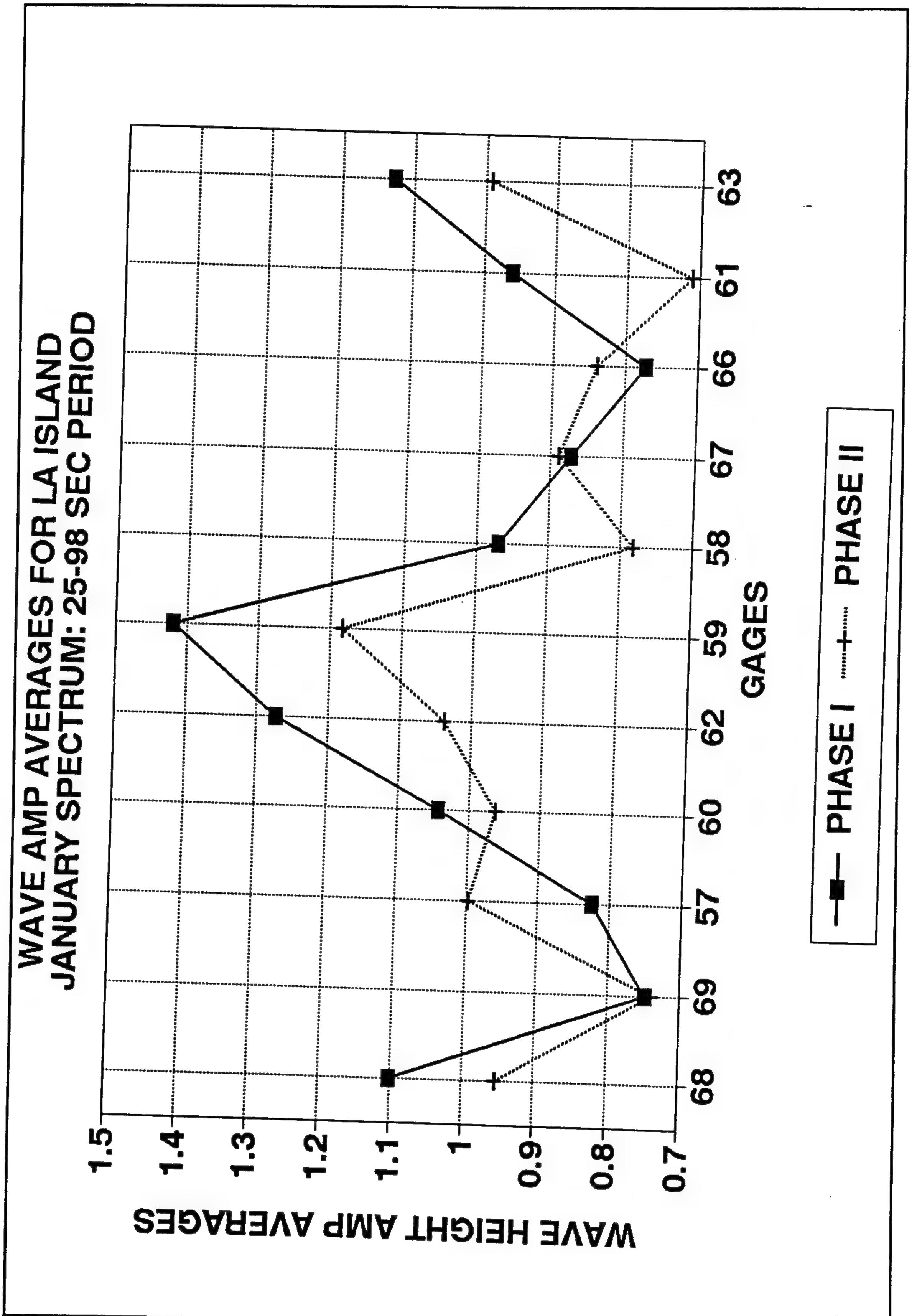
Plate 62



WAVE AMP AVERAGES FOR LB EAST
FEBRUARY SPECTRUM: 217-461 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
0
1
2
3
4
5
6
7
8
GAGES
50
51
52
53
54
55
42
BASE
PHASE I
PHASE II


Plate 63


WAVE AMP AVERAGES FOR LA ISLAND
UNIFORM SPECTRUM: 25-98 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
68
69
57
60
62
59
58
67
66
61
63
GAGES
PHASE I
PHASE II


WAVE AMP AVERAGES FOR LA ISLAND
JANUARY SPECTRUM: 25-98 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
GAGES
68
69
57
60
62
59
58
67
66
61
63
PHASE I
PHASE II

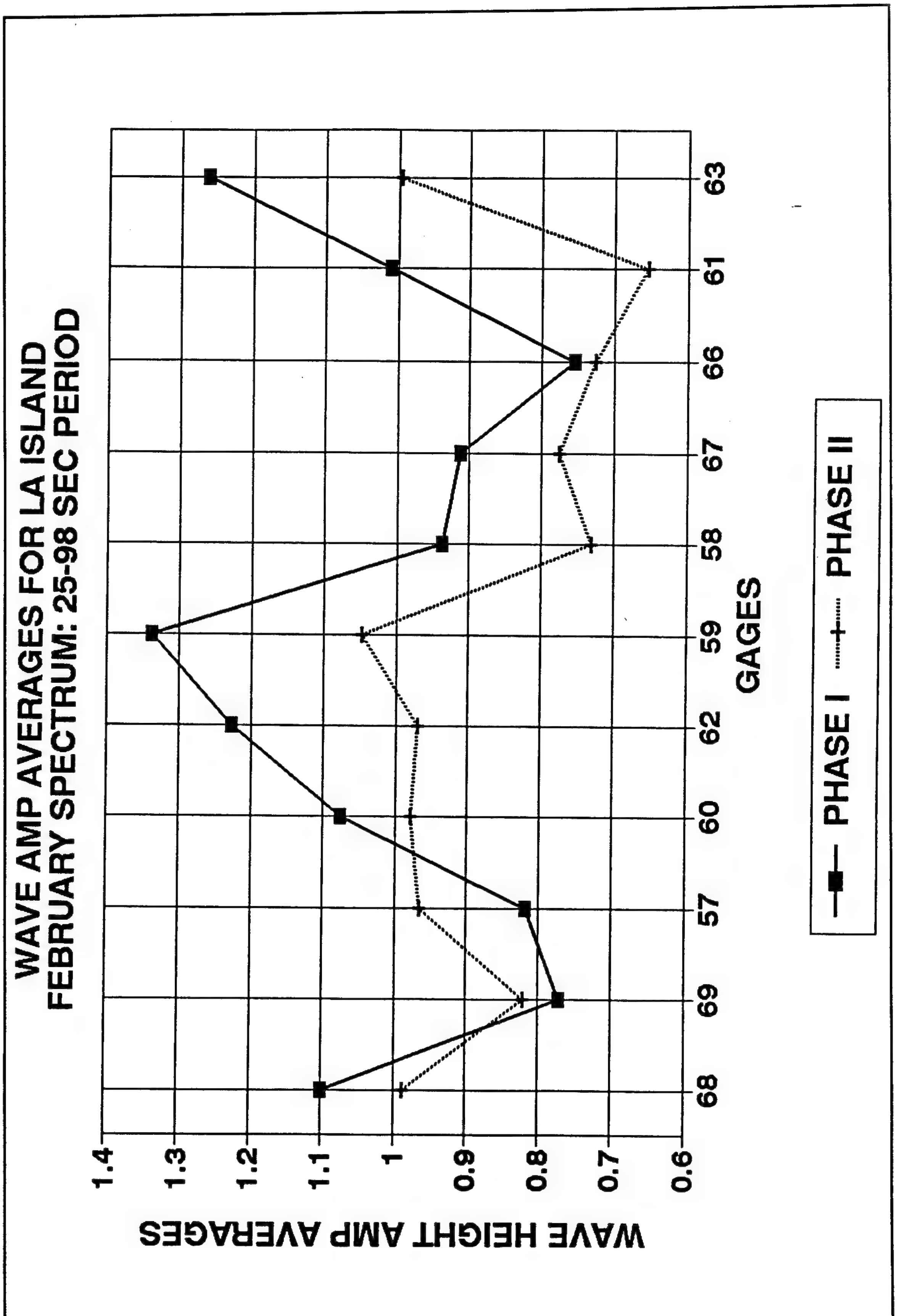

WAVE AMP AVERAGES FOR LA ISLAND
FEBRUARY SPECTRUM: 25-98 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
68
69
57
60
62
59
58
67
66
61
63
GAGES
PHASE I
PHASE II

Plate 66

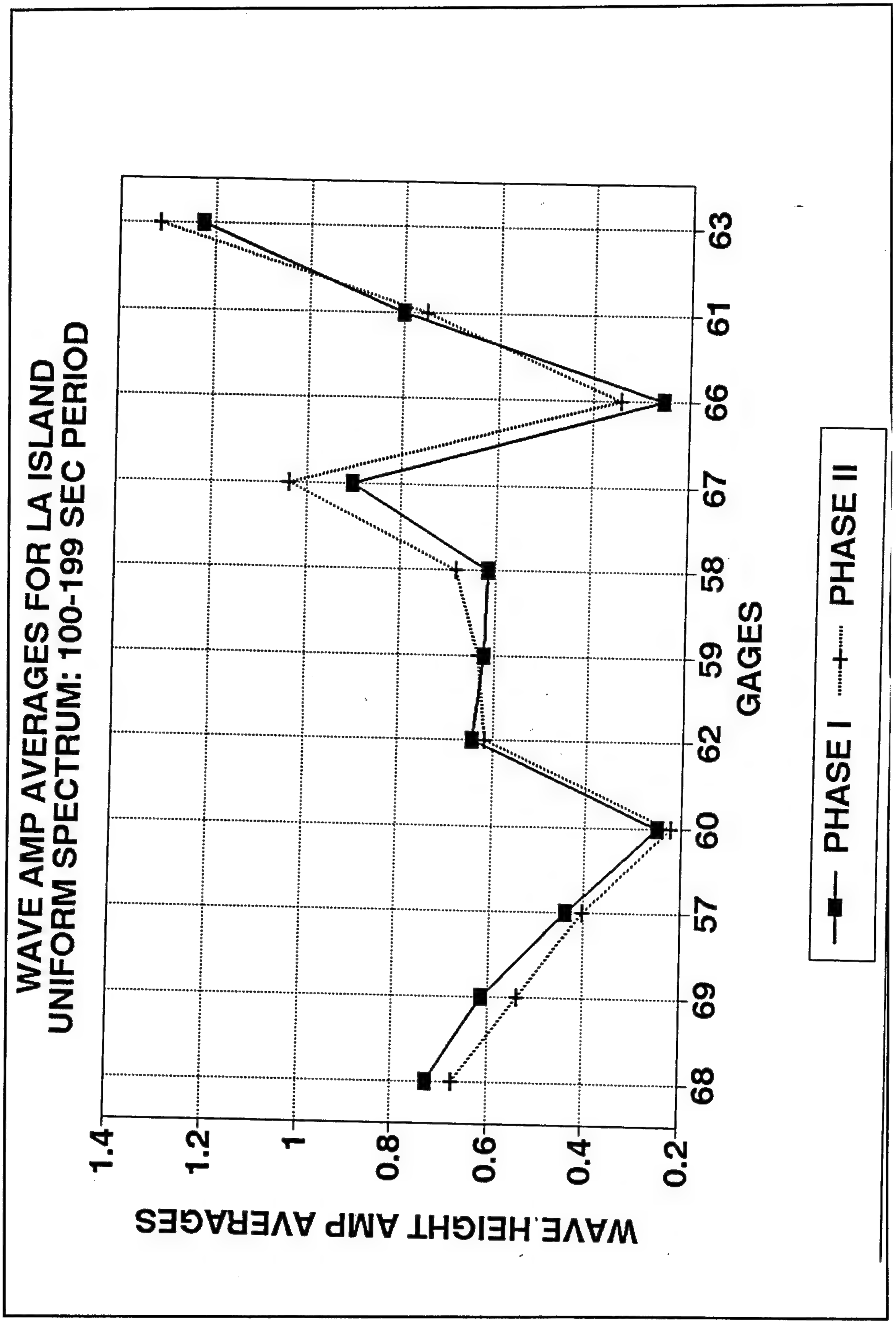
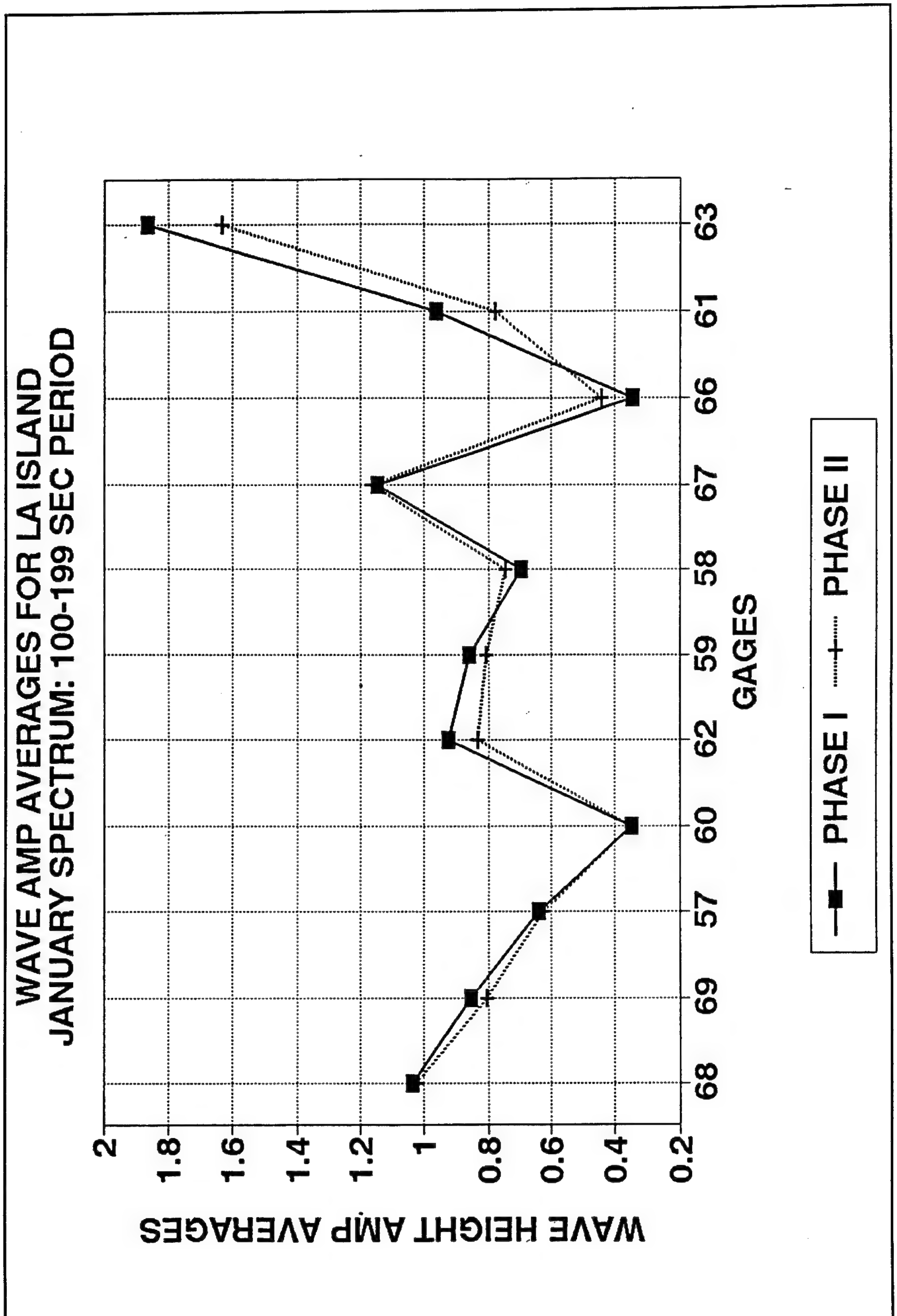
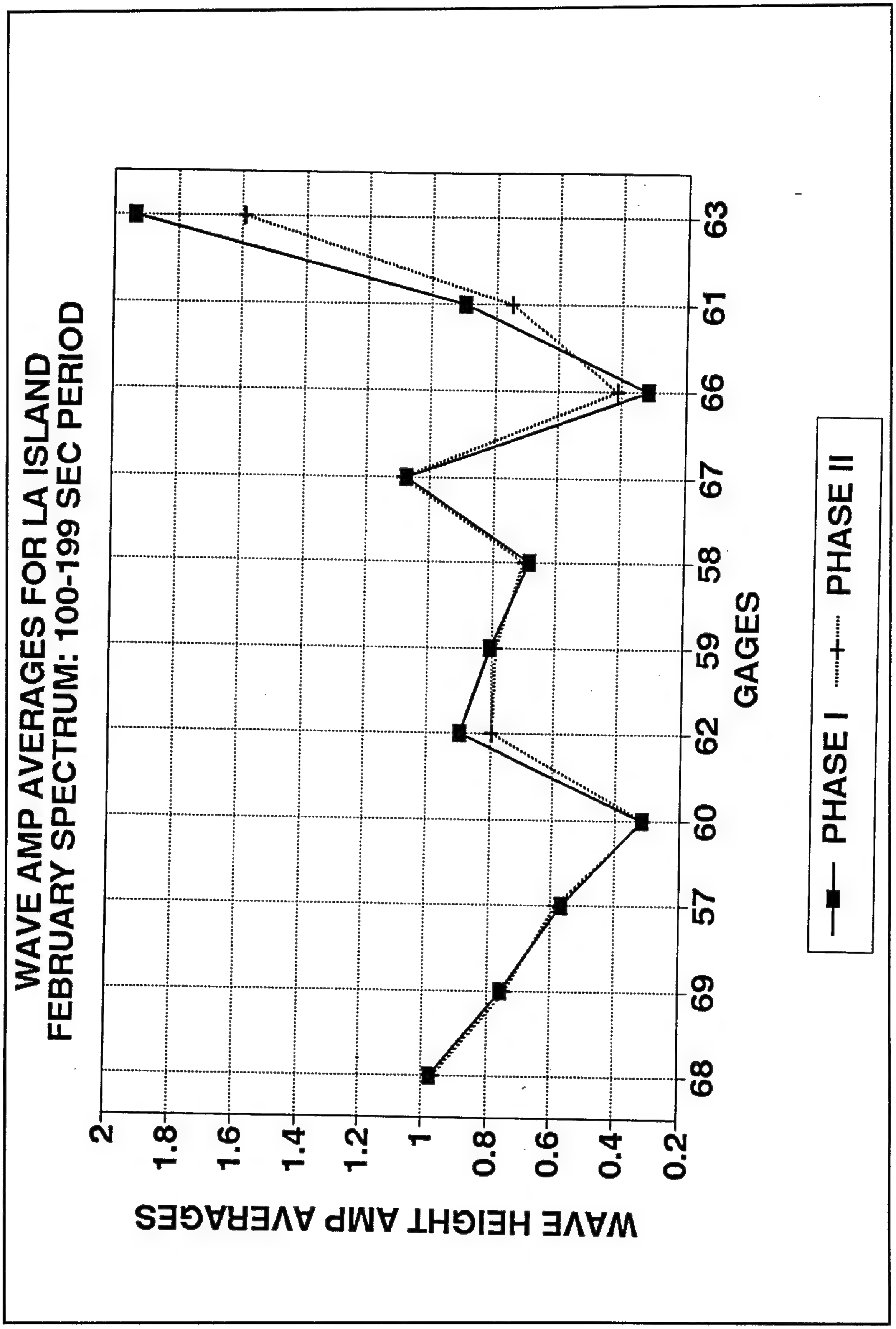

WAVE AMP AVERAGES FOR LA ISLAND
UNIFORM SPECTRUM: 100-199 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
1.4
1.2
1
0.8
0.6
0.4
0.2
68
69
57
60
62
59
58
67
66
61
63
GAGES
PHASE I
PHASE II

Plate 67



WAVE AMP AVERAGES FOR LA ISLAND
JANUARY SPECTRUM: 100-199 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
68
69
57
60
62
59
58
67
66
61
63
GAGES
PHASE I
PHASE II


Plate 68


WAVE AMP AVERAGES FOR LA ISLAND
FEBRUARY SPECTRUM: 100-199 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
68
69
57
60
62
59
58
67
66
61
63
GAGES
PHASE I
PHASE II

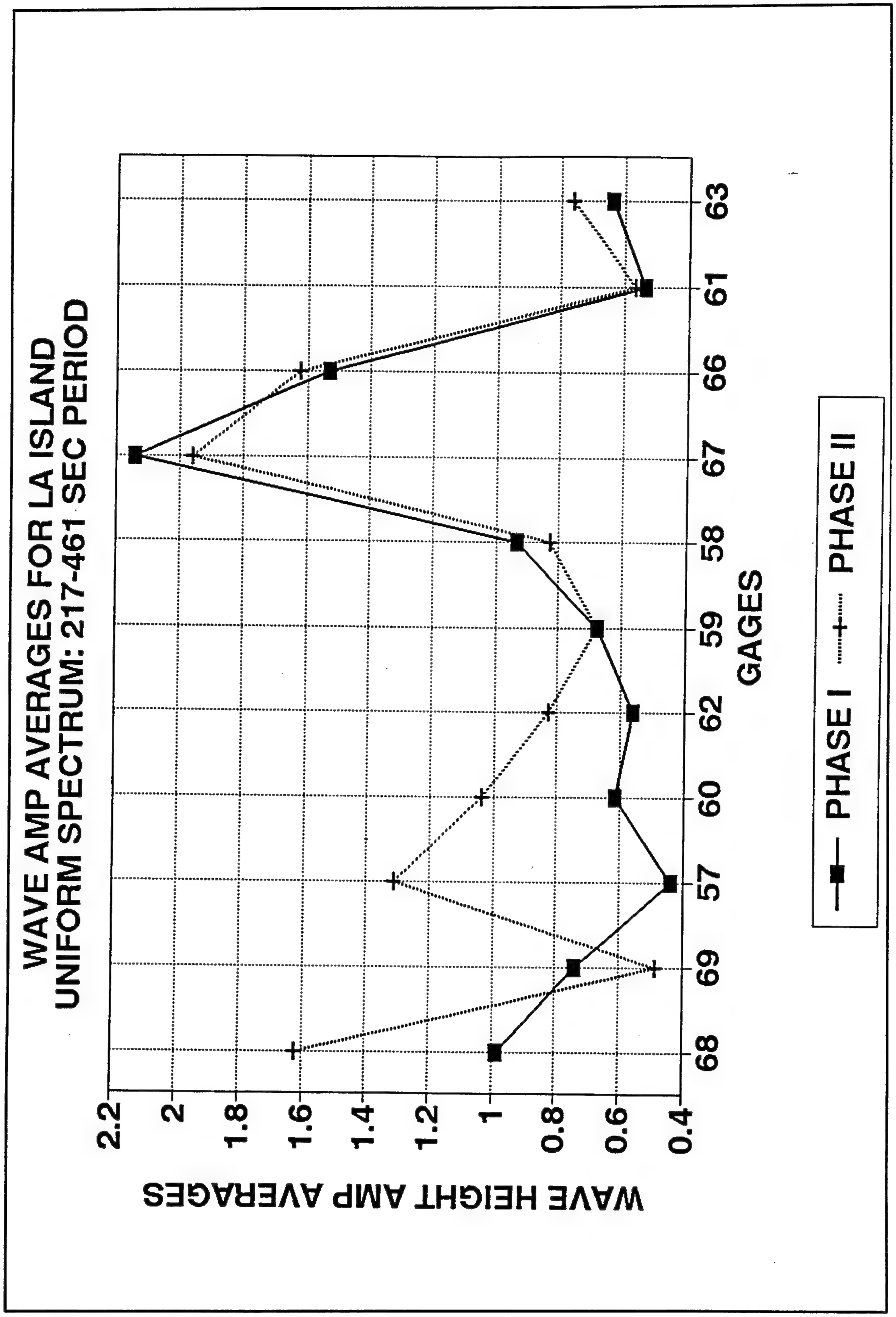
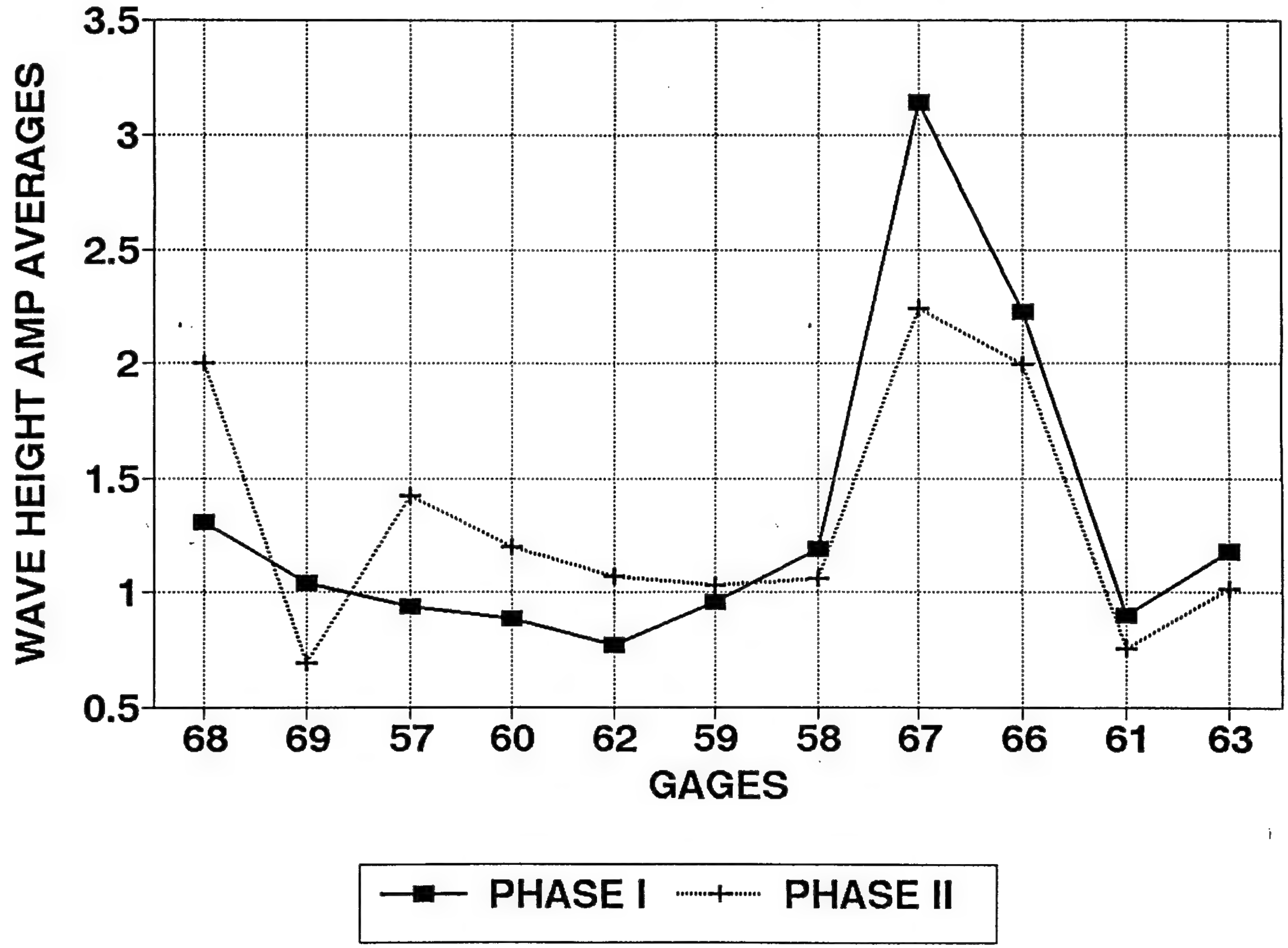

WAVE AMP AVERAGES FOR LA ISLAND
UNIFORM SPECTRUM: 217-461 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
68
69
57
60
62
59
58
67
66
61
63
GAGES
PHASE I
PHASE II

Plate 70

WAVE AMP AVERAGES FOR LA ISLAND
JANUARY SPECTRUM: 217-461 SEC PERIOD



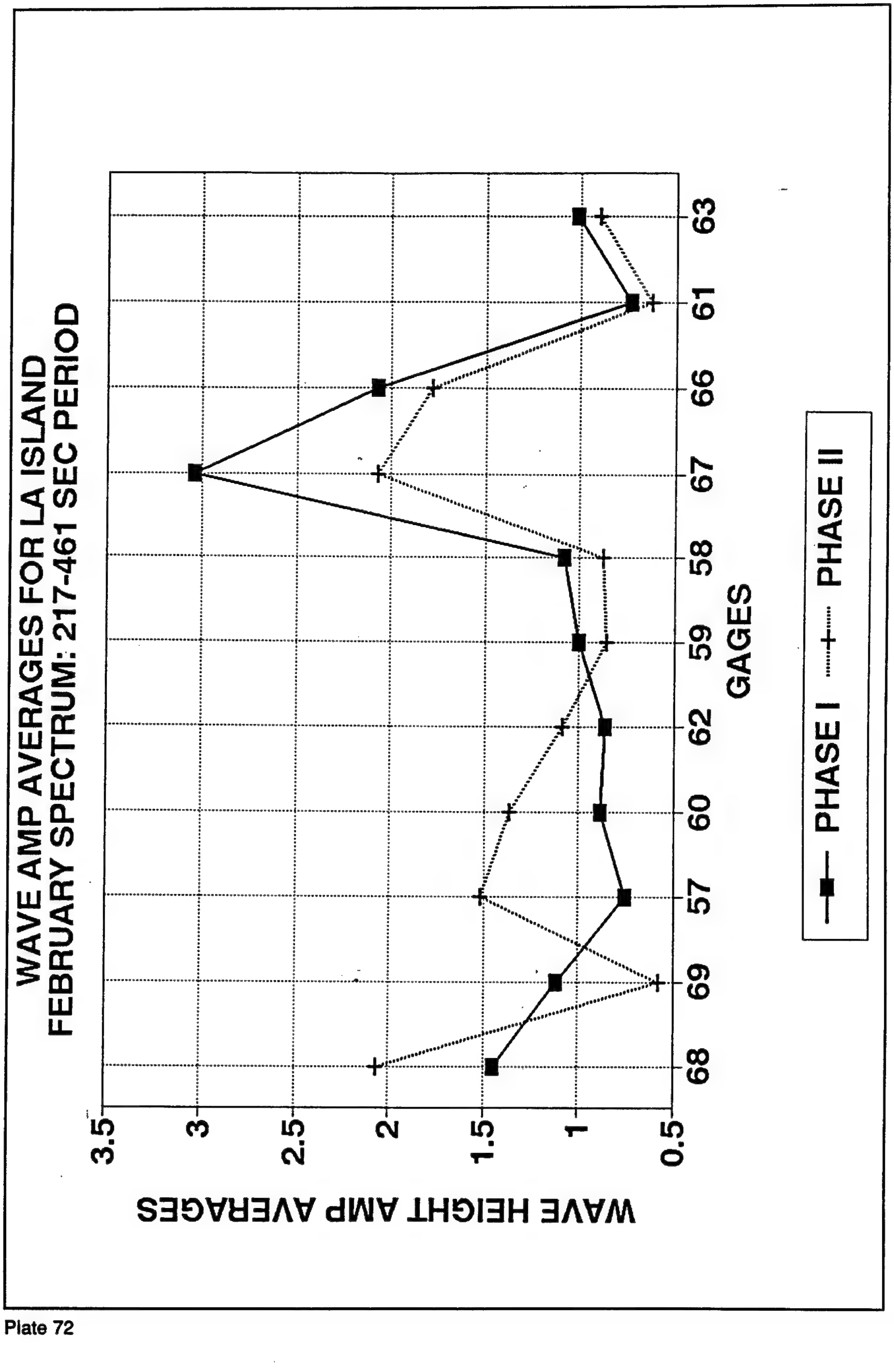
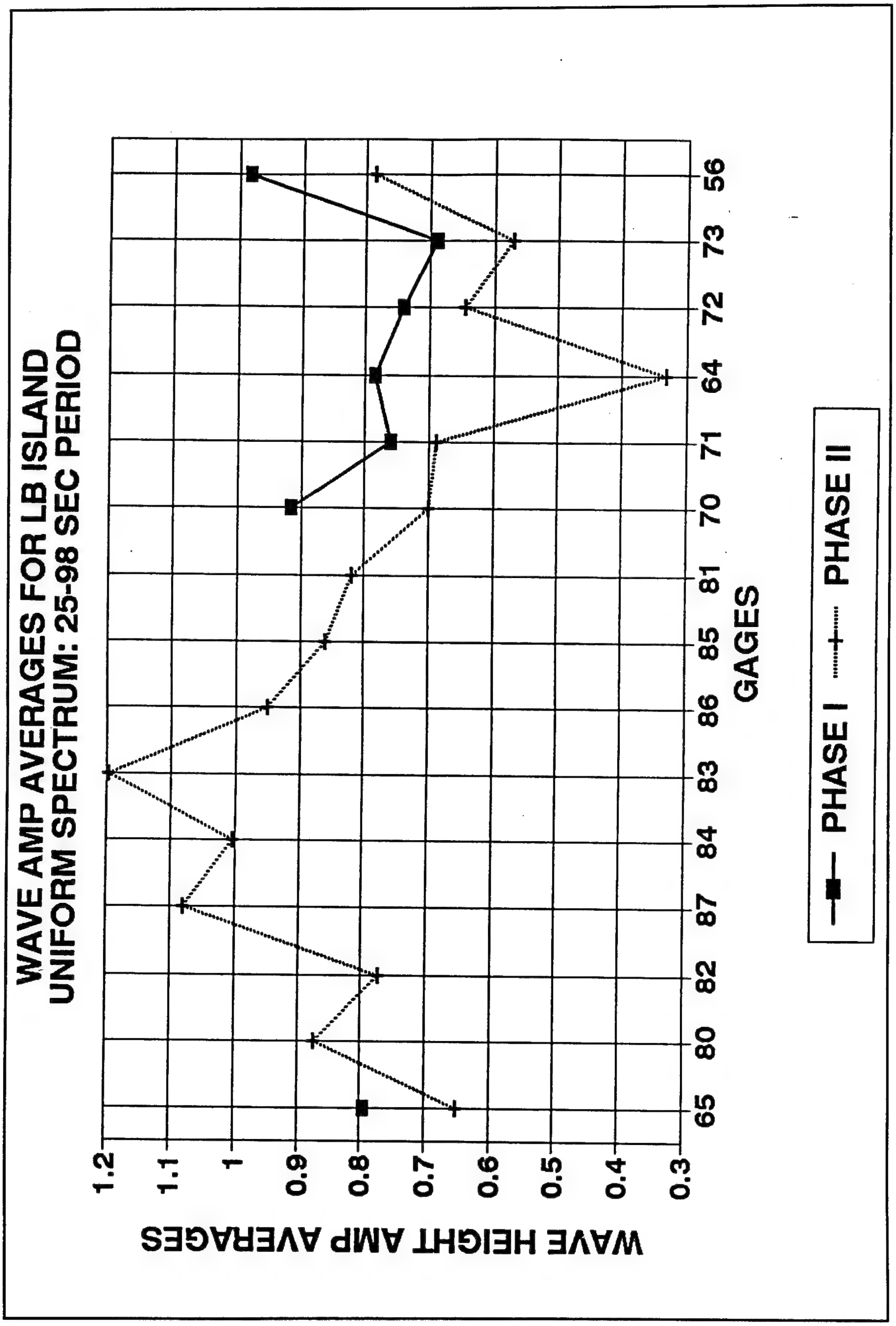

WAVE AMP AVERAGES FOR LA ISLAND
FEBRUARY SPECTRUM: 217-461 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
3.5
3
2.5
2
1.5
1
0.5
68
69
57
60
62
59
58
67
66
61
63
GAGES
PHASE I
PHASE II

Plate 72



WAVE AMP AVERAGES FOR LB ISLAND
UNIFORM SPECTRUM: 25-98 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
65
80
82
87
84
83
86
85
81
70
71
64
72
73
56
GAGES
PHASE I
PHASE II

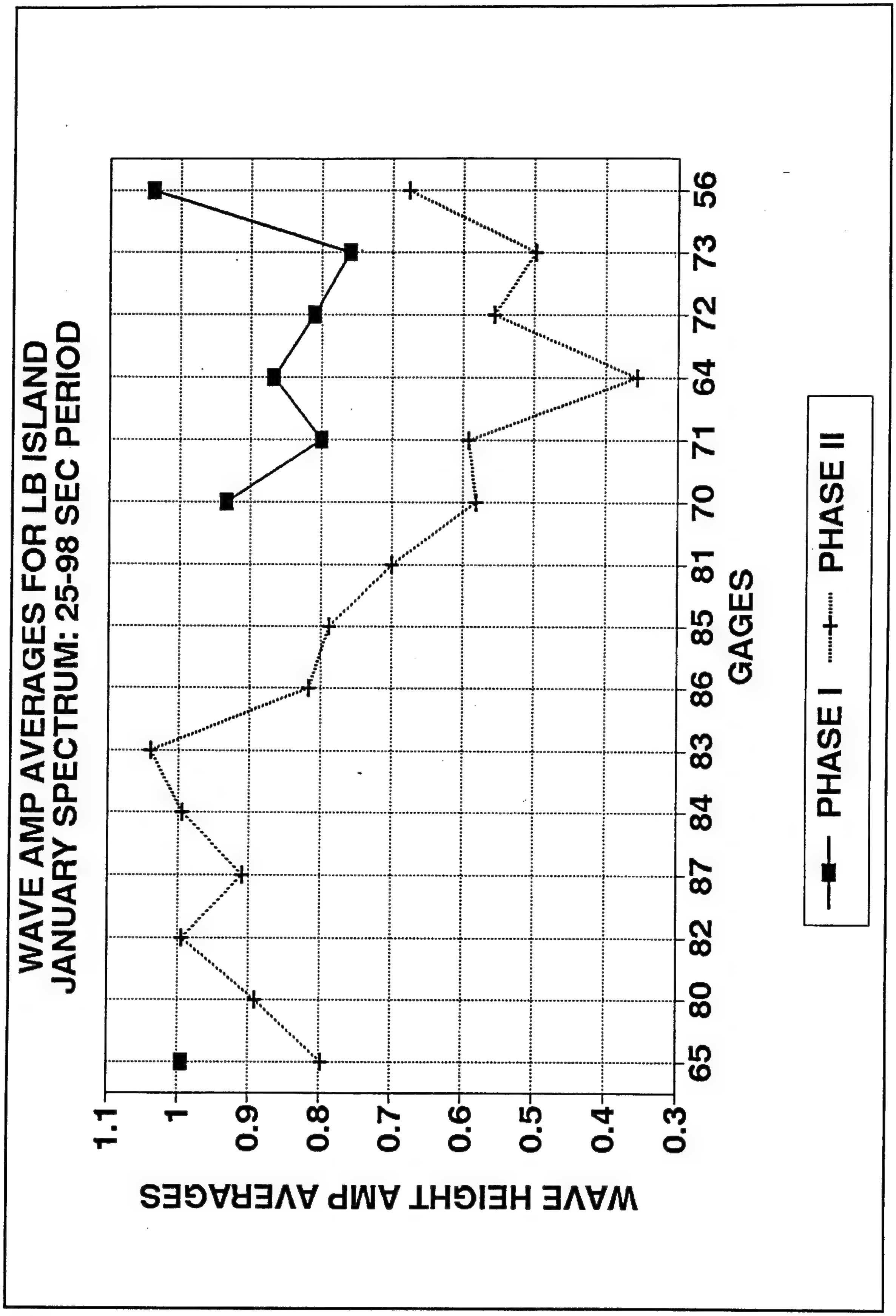
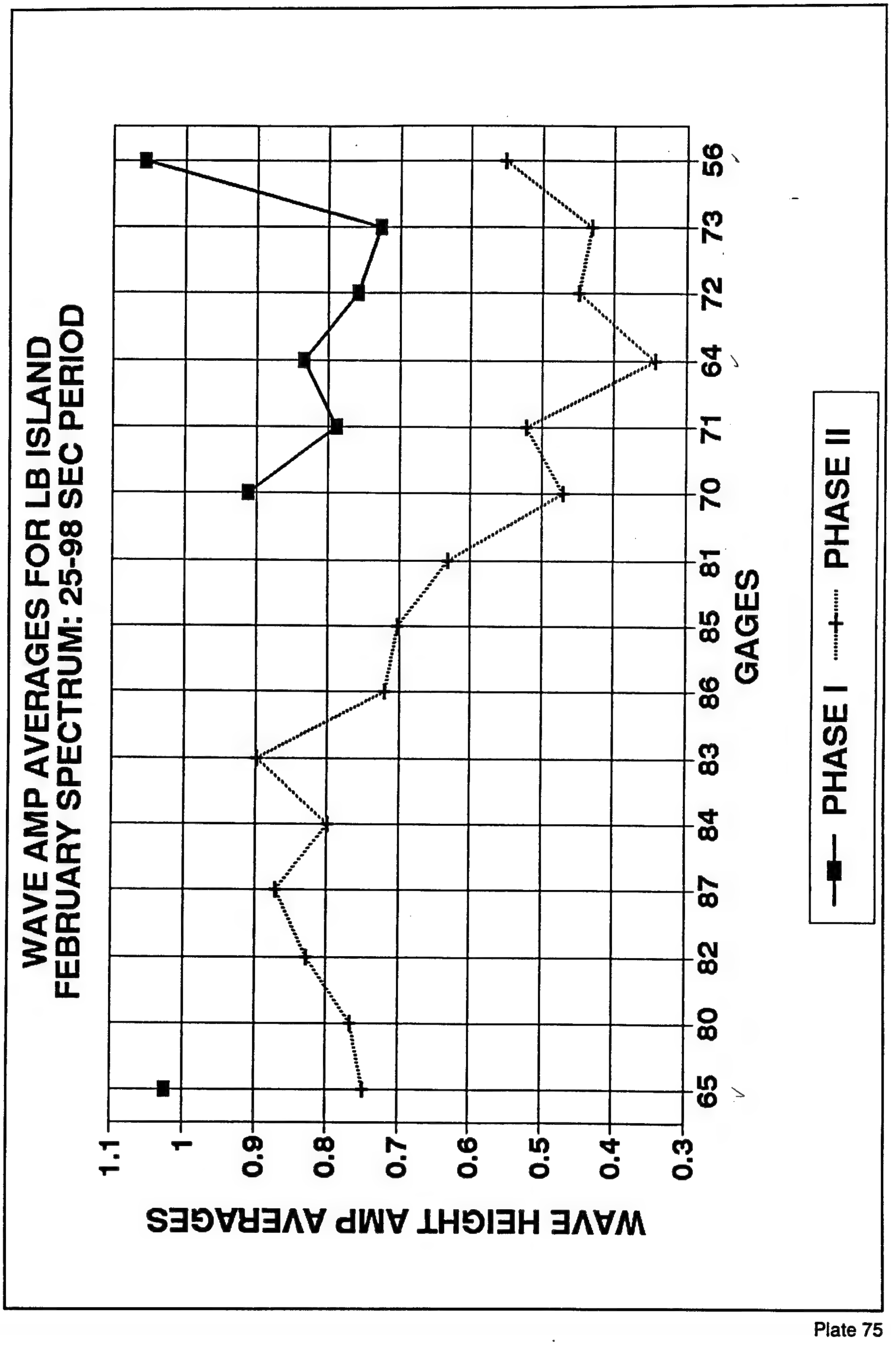

WAVE AMP AVERAGES FOR LB ISLAND
JANUARY SPECTRUM: 25-98 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
65
80
82
87
84
83
86
85
81
70
71
64
72
73
56
GAGES
PHASE I
PHASE II

Plate 74


WAVE AMP AVERAGES FOR LB ISLAND
FEBRUARY SPECTRUM: 25-98 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
65
80
82
87
84
83
86
85
81
70
71
64
72
73
56
GAGES
PHASE I
PHASE II

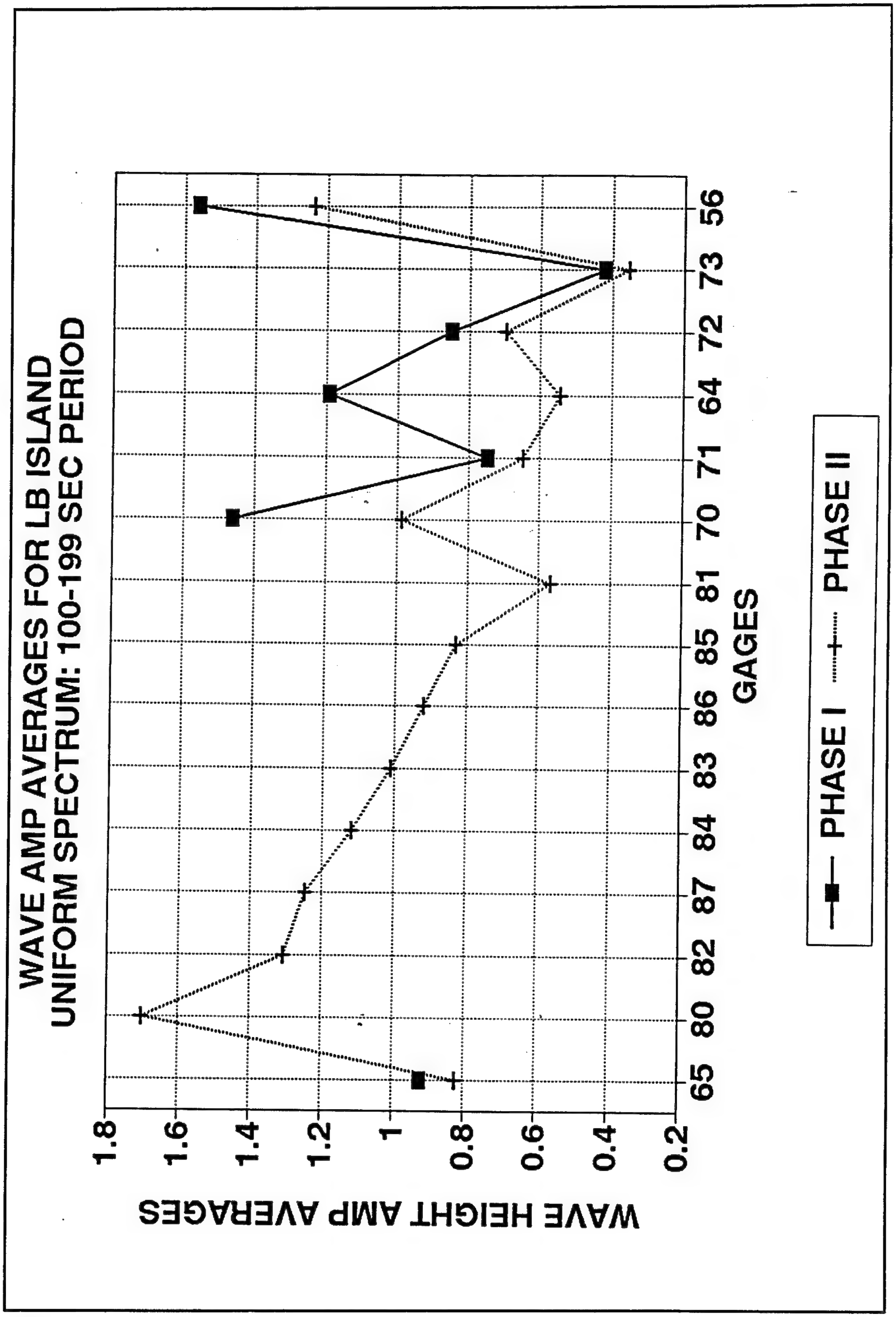

WAVE AMP AVERAGES FOR LB ISLAND
UNIFORM SPECTRUM: 100-199 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
65
80
82
87
84
83
86
85
81
70
71
64
72
73
56
GAGES
PHASE I
PHASE II

Plate 76

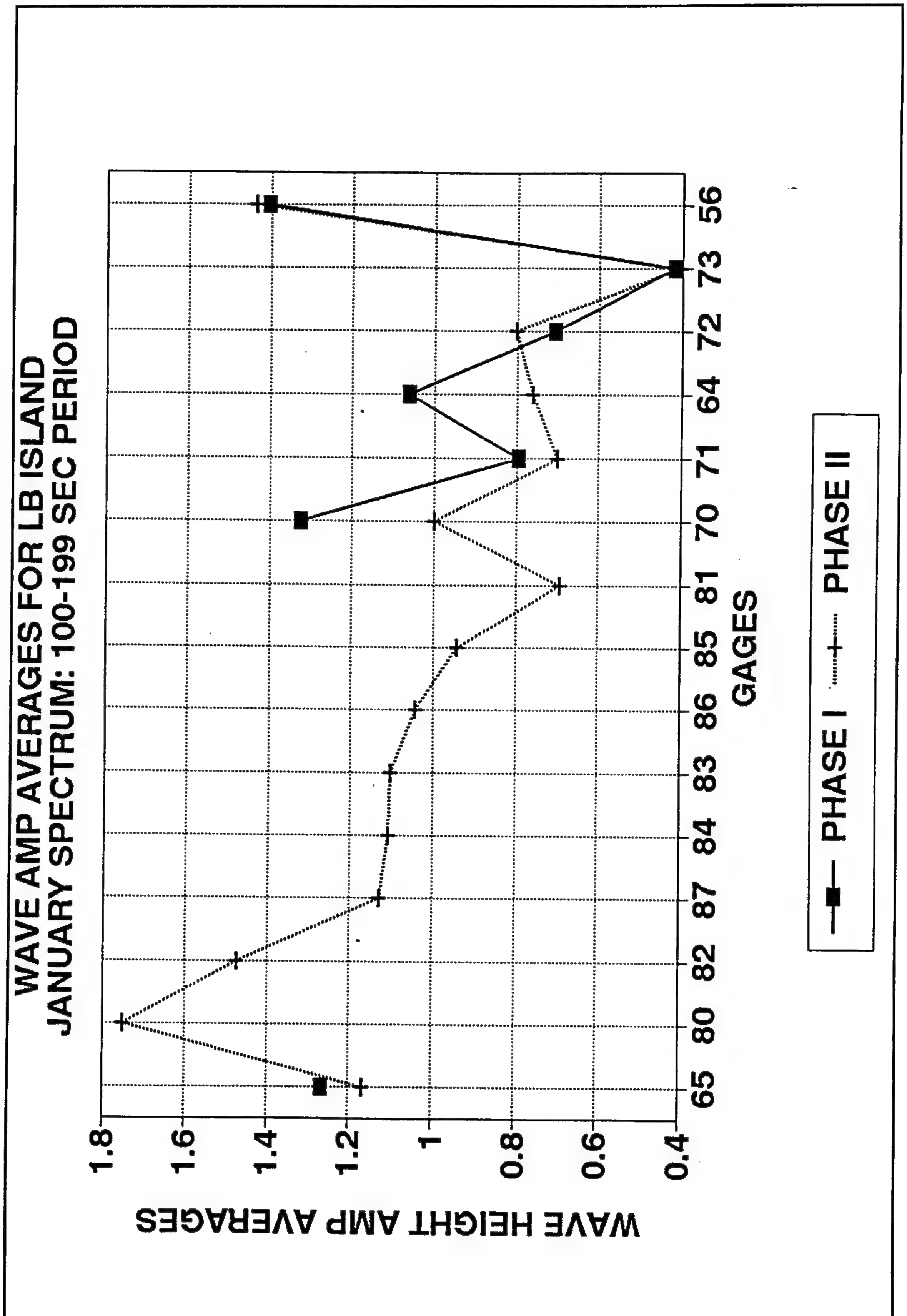

WAVE AMP AVERAGES FOR LB ISLAND
JANUARY SPECTRUM: 100-199 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
65 80 82 87 84 83 86 85 81 70 71 64 72 73 56
GAGES
PHASE I
PHASE II

Plate 77

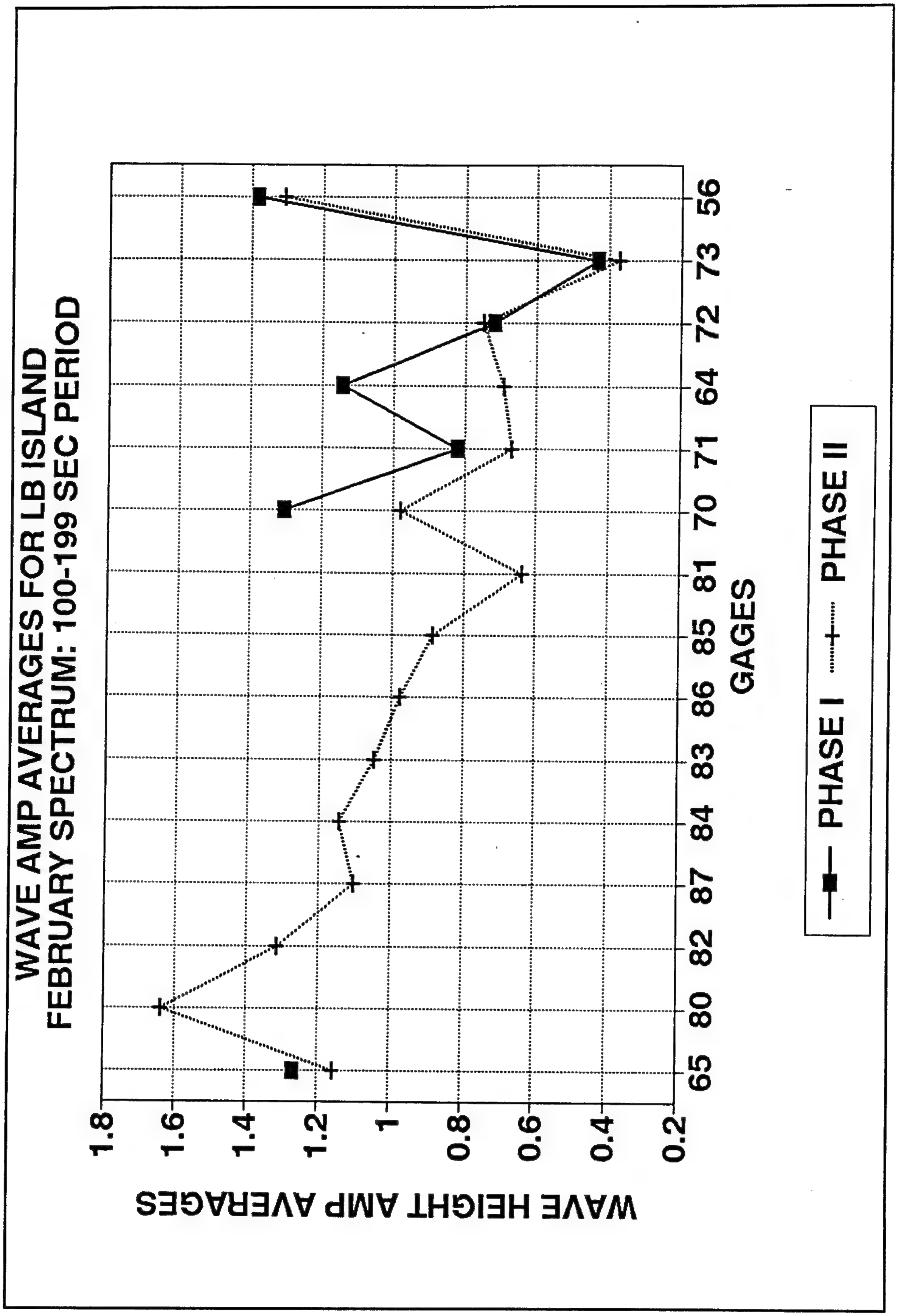
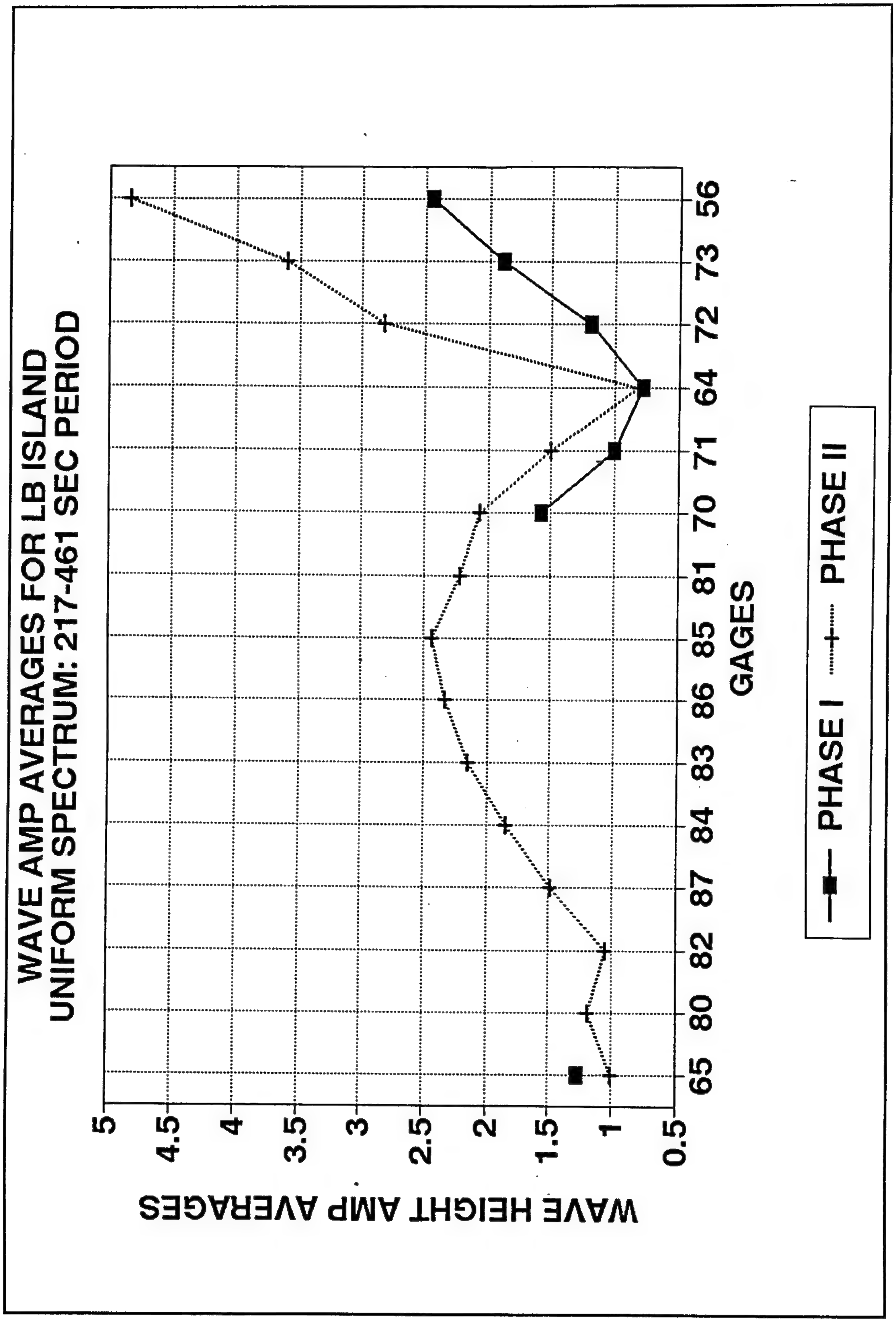

WAVE AMP AVERAGES FOR LB ISLAND
FEBRUARY SPECTRUM: 100-199 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
65 80 82 87 84 83 86 85 81 70 71 64 72 73 56
GAGES
PHASE I
PHASE II

Plate 78


WAVE AMP AVERAGES FOR LB ISLAND
UNIFORM SPECTRUM: 217-461 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
65
80
82
87
84
83
86
85
81
70
71
64
72
73
56
GAGES
PHASE I
PHASE II

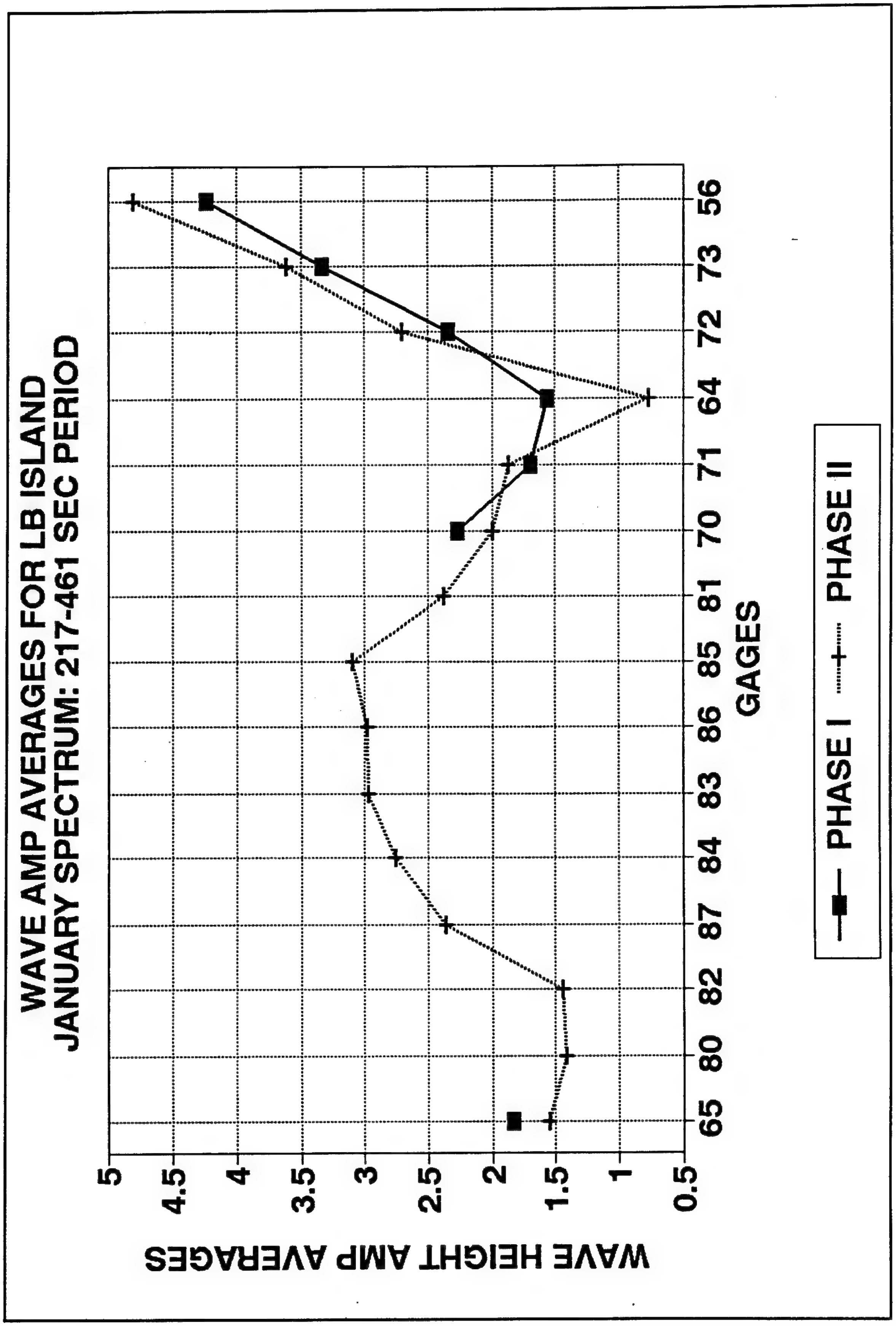
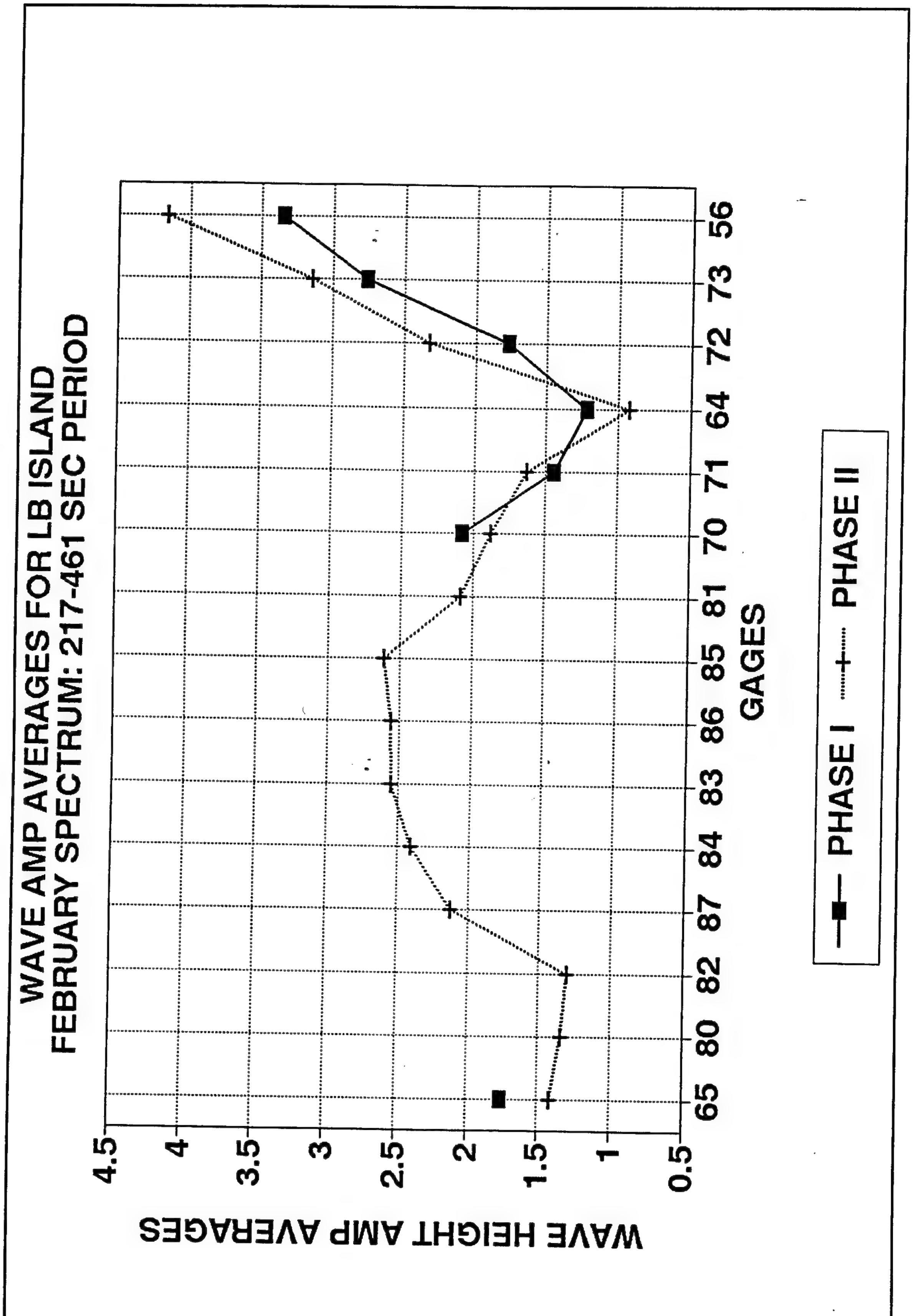
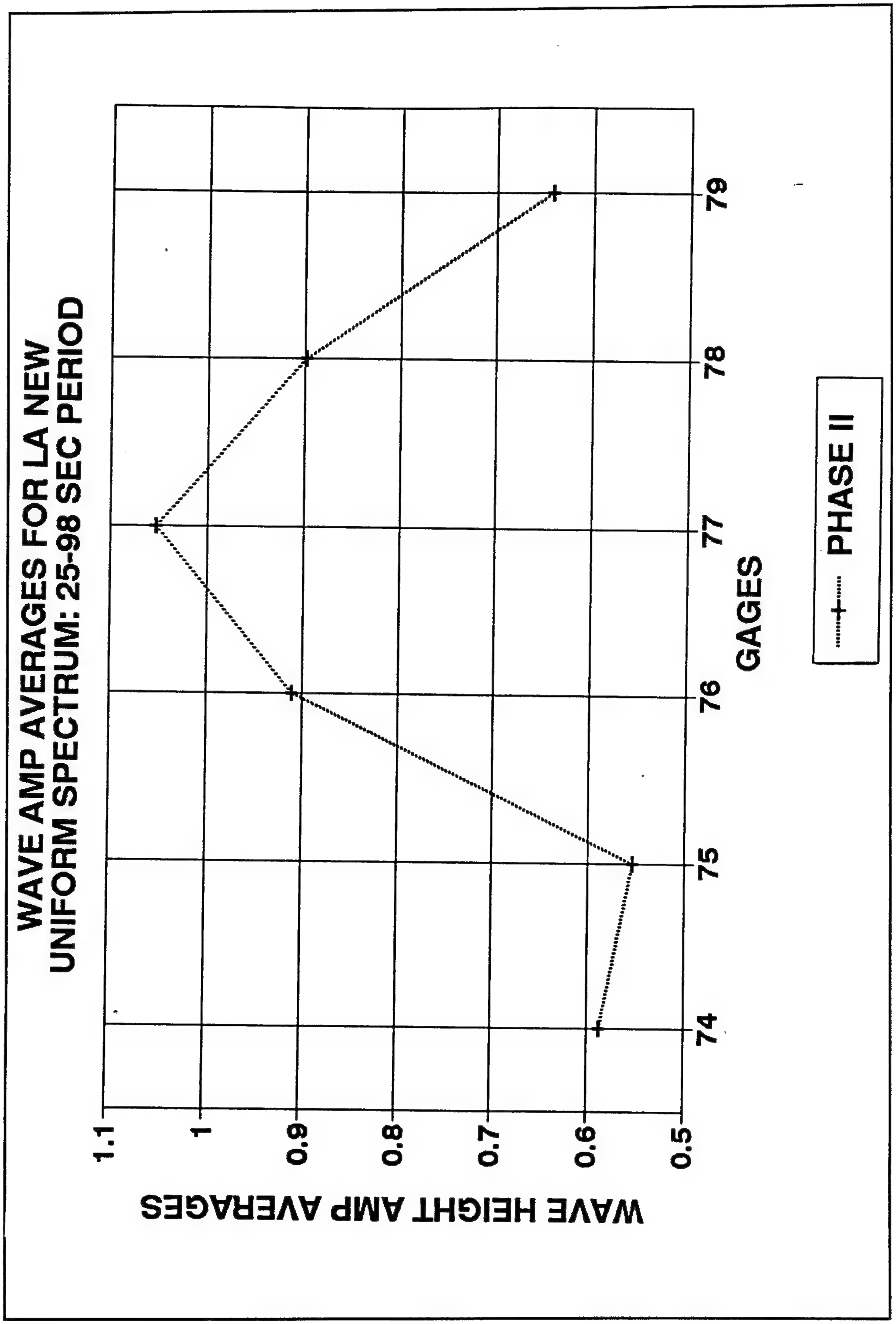

WAVE AMP AVERAGES FOR LB ISLAND
JANUARY SPECTRUM: 217-461 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
65
80
82
87
84
83
86
85
81
70
71
64
72
73
56
GAGES
PHASE I
PHASE II

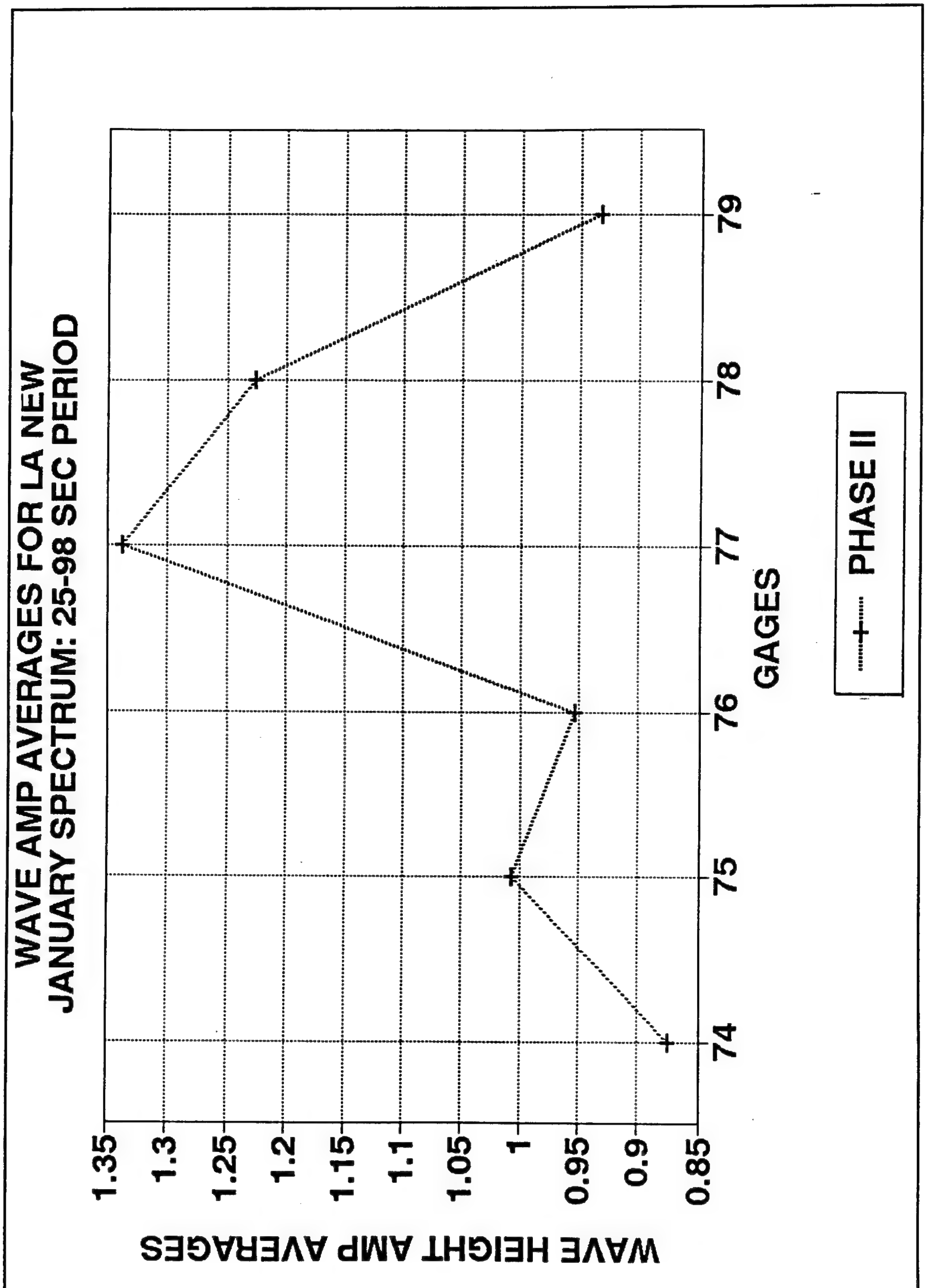
Plate 80


WAVE AMP AVERAGES FOR LB ISLAND
FEBRUARY SPECTRUM: 217-461 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
4.5
4
3.5
3
2.5
2
1.5
1
0.5
65
80
82
87
84
83
86
85
81
70
71
64
72
73
56
GAGES
PHASE I
PHASE II



WAVE AMP AVERAGES FOR LA NEW
UNIFORM SPECTRUM: 25-98 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
1.1
1
0.9
0.8
0.7
0.6
0.5
74
75
76
77
78
79
GAGES
PHASE II


Plate 82


WAVE AMP AVERAGES FOR LA NEW
JANUARY SPECTRUM: 25-98 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
1.35
1.3
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
74
75
76
77
78
79
GAGES
PHASE II

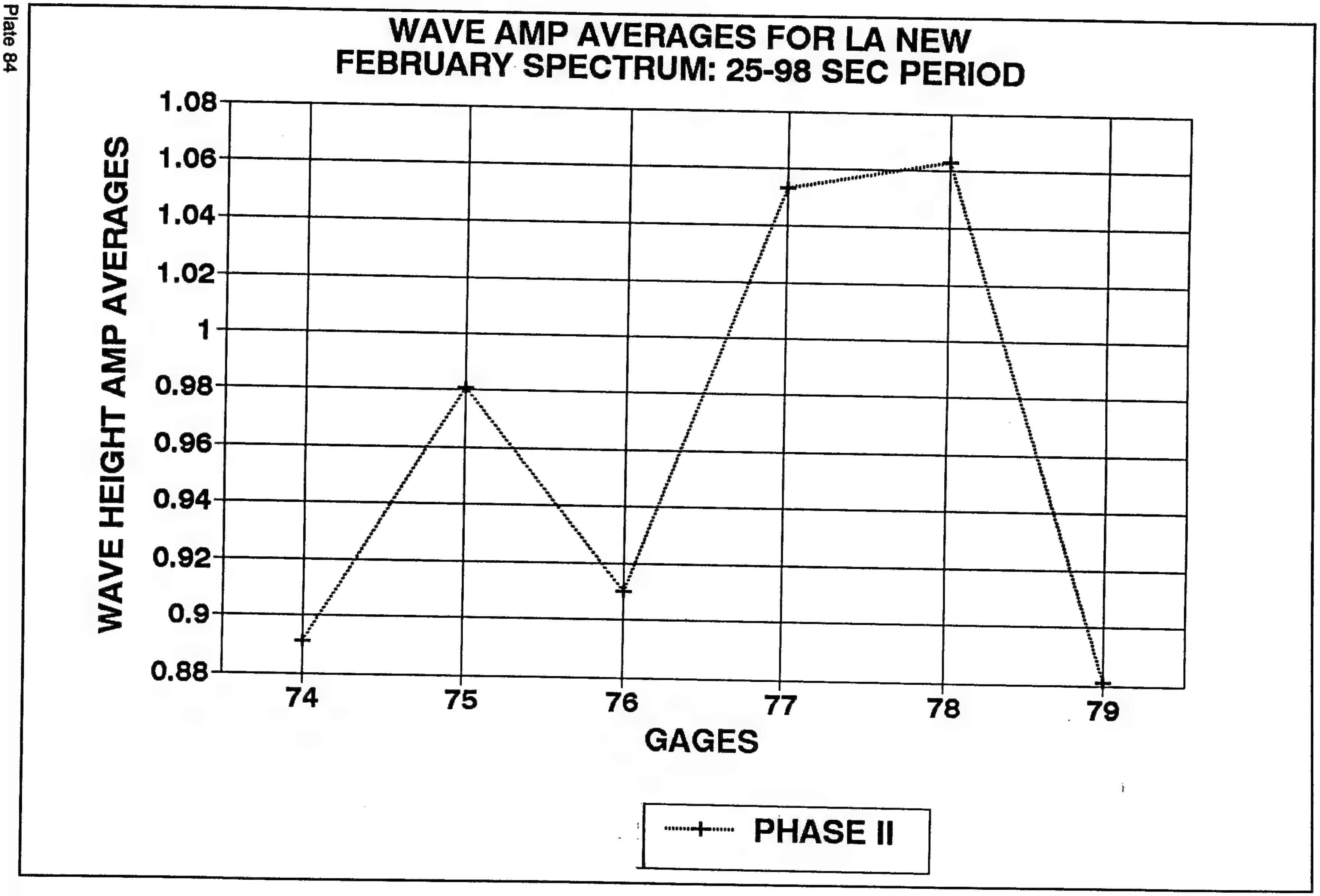
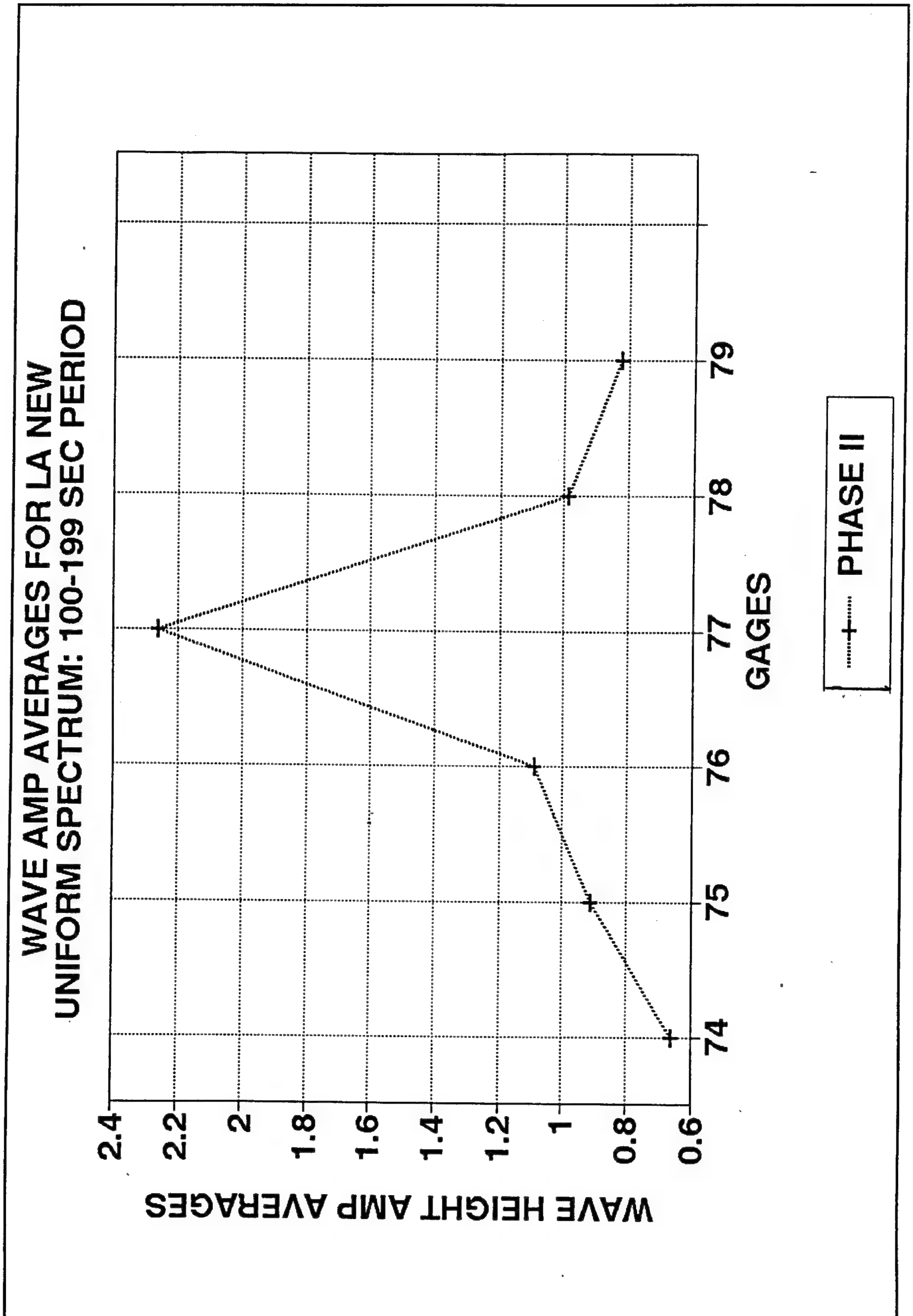

WAVE AMP AVERAGES FOR LA NEW
FEBRUARY SPECTRUM: 25-98 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
1.08
1.06
1.04
1.02
1
0.98
0.96
0.94
0.92
0.9
0.88
74
75
76
77
78
79
GAGES
PHASE II

Plate 84


WAVE AMP AVERAGES FOR LA NEW
UNIFORM SPECTRUM: 100-199 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
74
75
76
77
78
79
GAGES
PHASE II

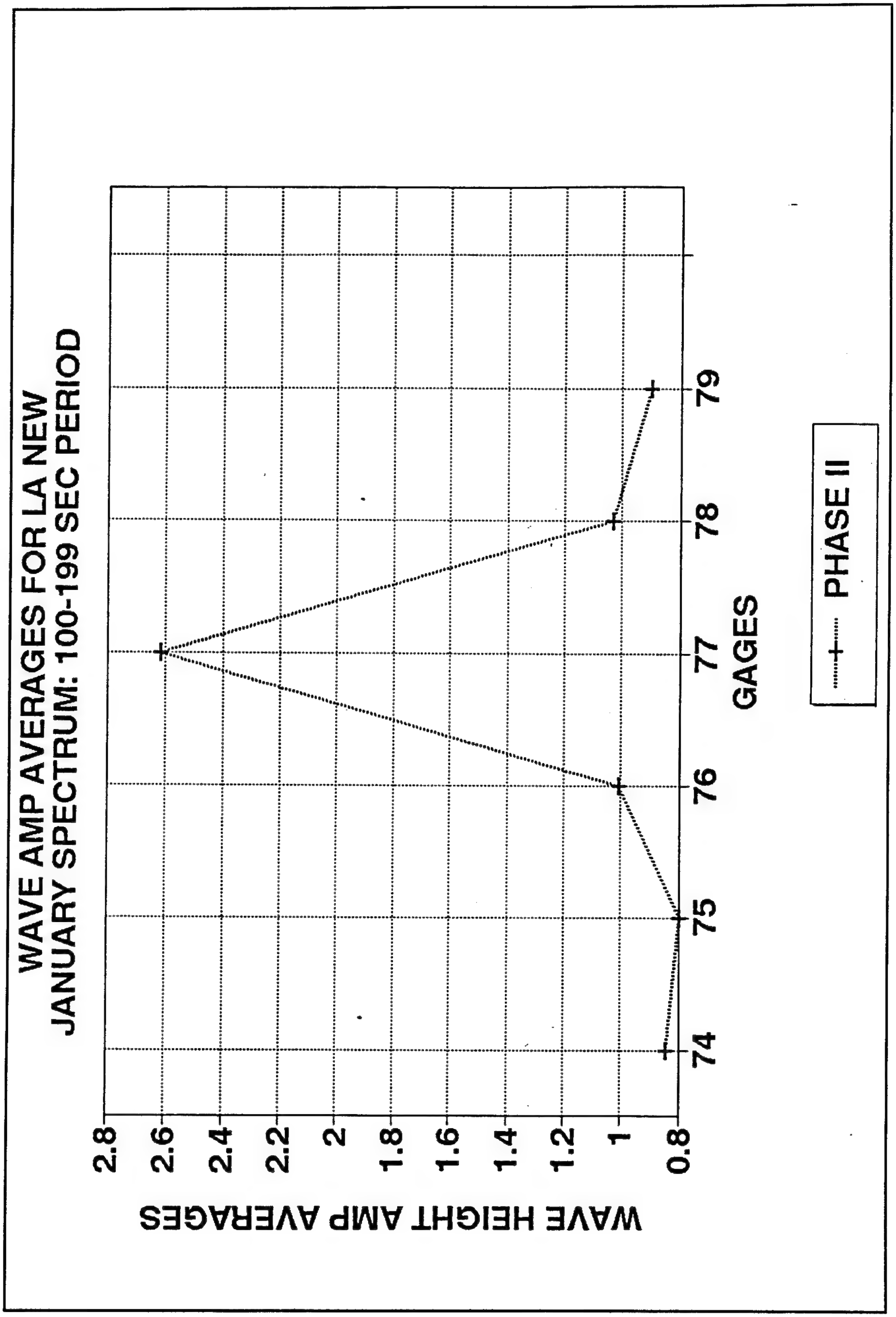
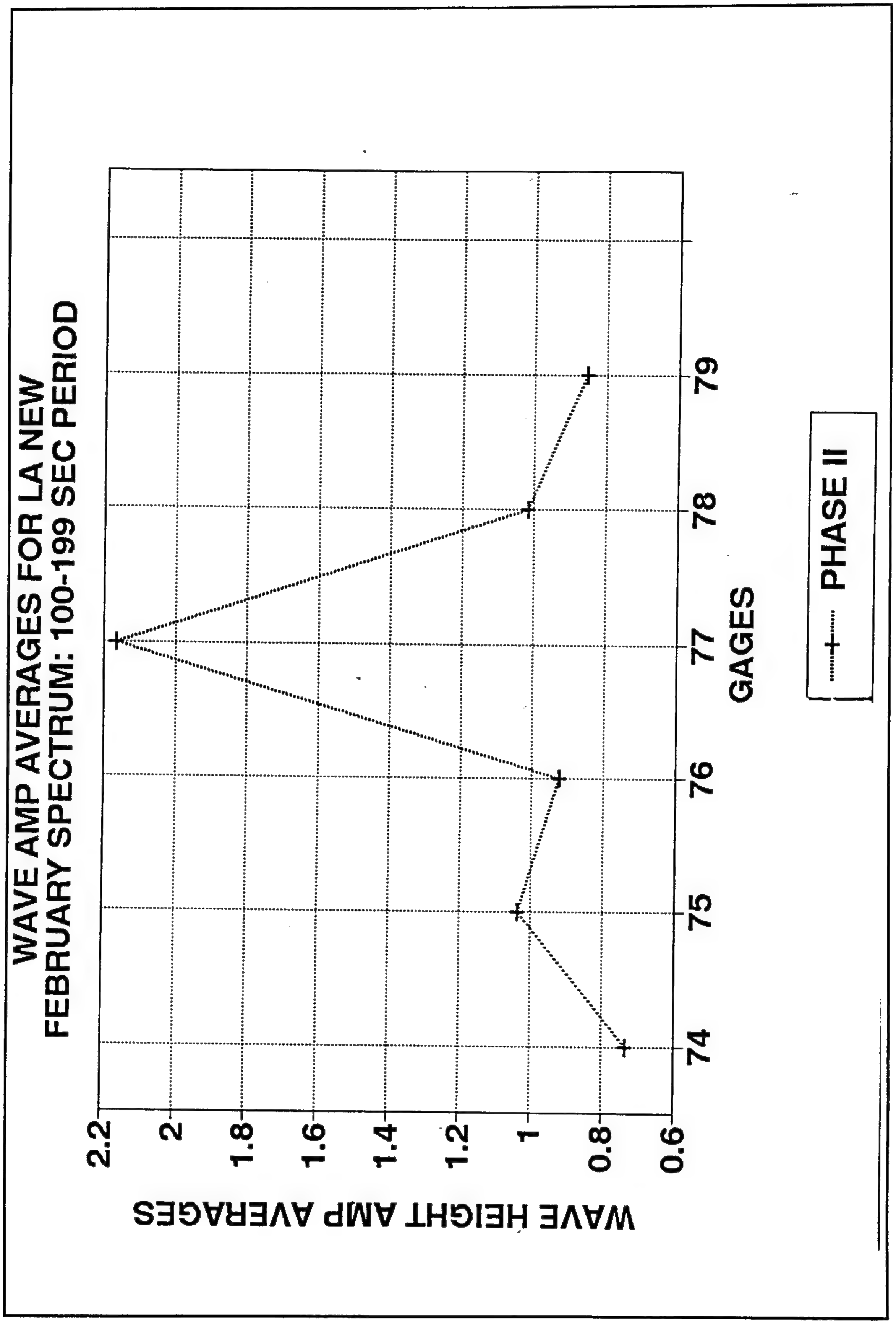

WAVE AMP AVERAGES FOR LA NEW
JANUARY SPECTRUM: 100-199 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
74
75
76
77
78
79
GAGES
PHASE II

Plate 86


WAVE AMP AVERAGES FOR LA NEW
FEBRUARY SPECTRUM: 100-199 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
74
75
76
77
78
79
GAGES
PHASE II

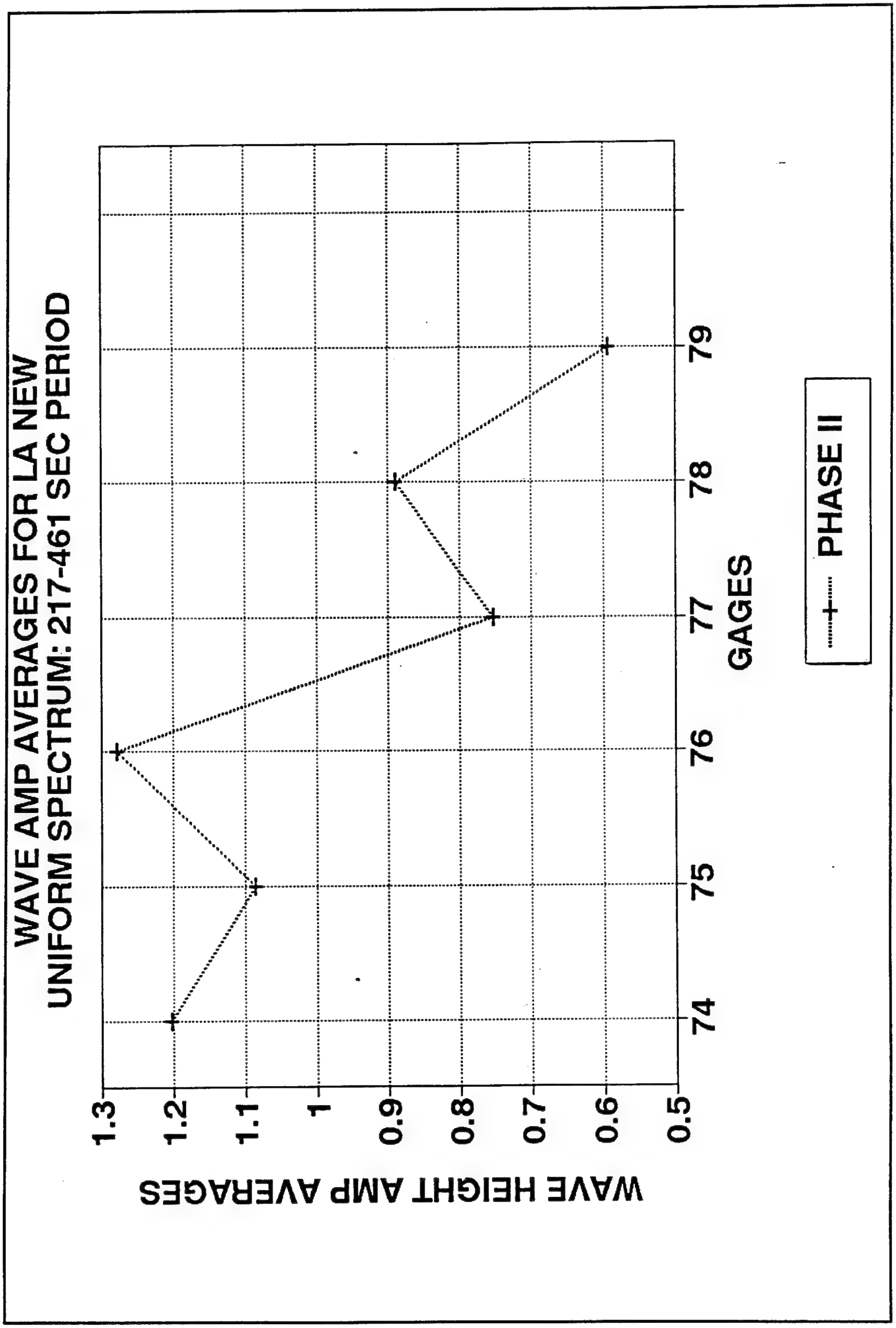
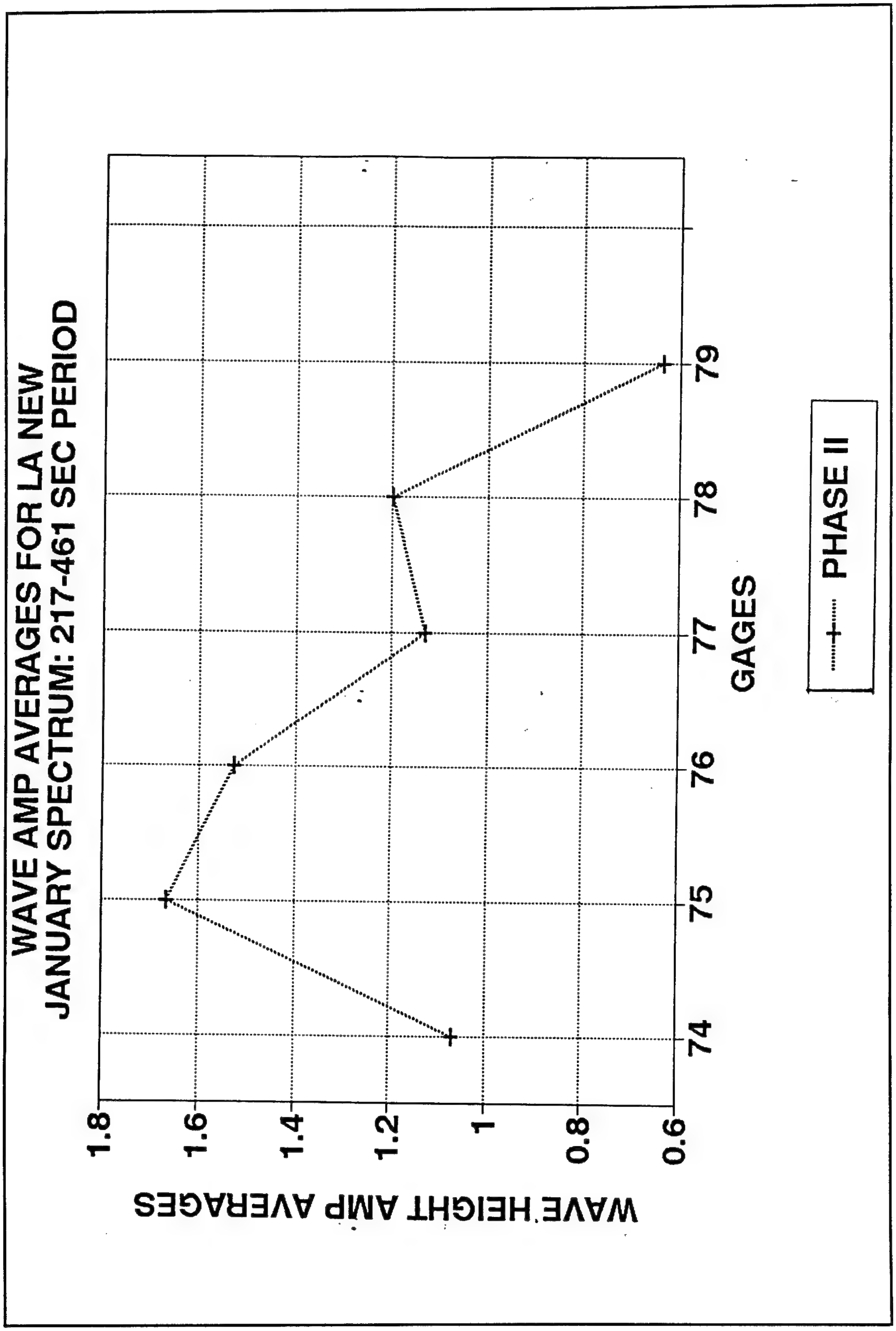
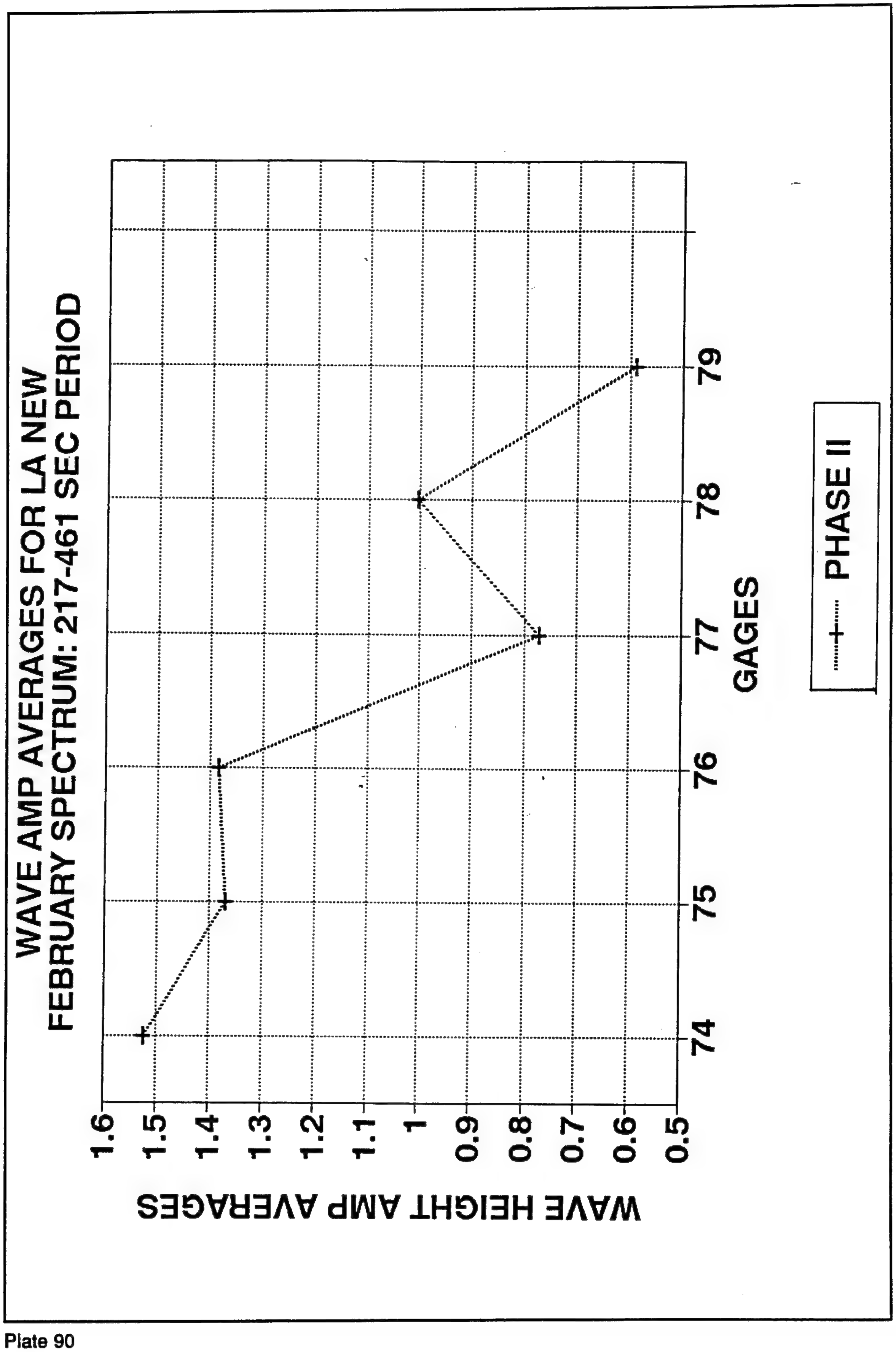

WAVE AMP AVERAGES FOR LA NEW
UNIFORM SPECTRUM: 217-461 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
74
75
76
77
78
79
GAGES
PHASE II

Plate 88

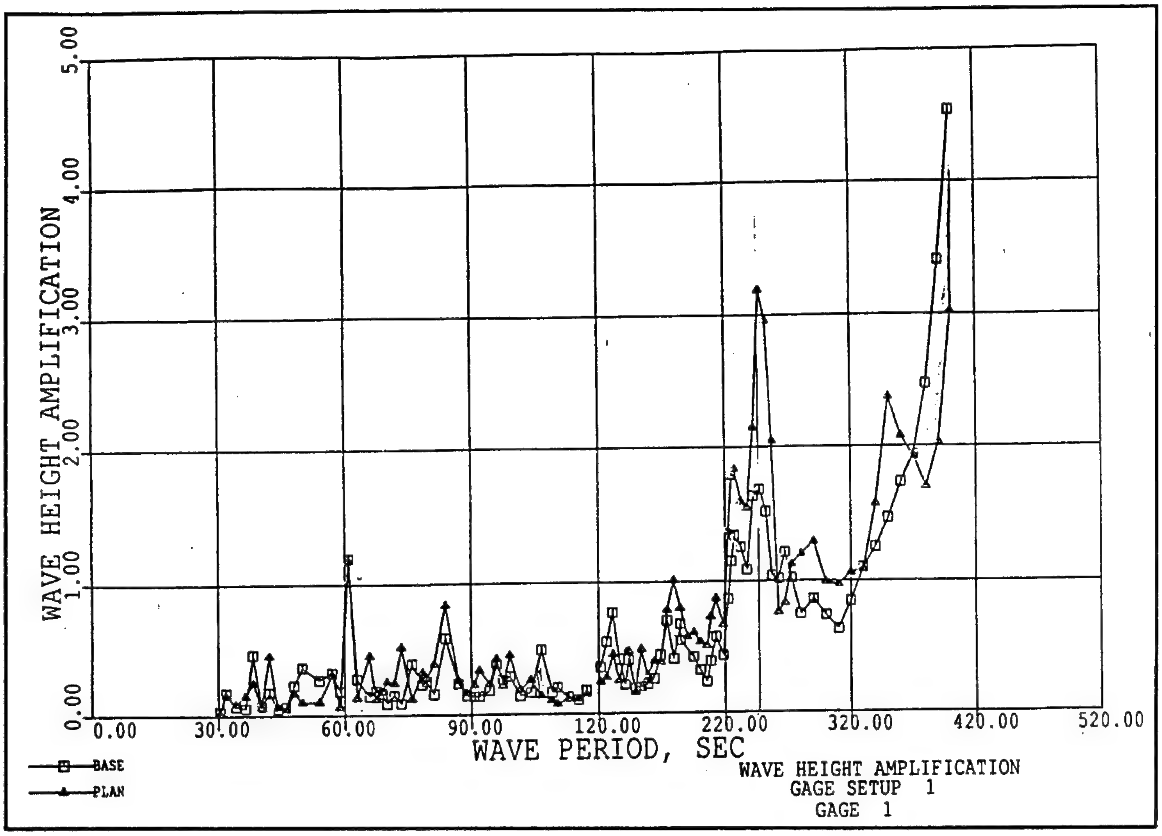

WAVE AMP AVERAGES FOR LA NEW
JANUARY SPECTRUM: 217-461 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
1.8
1.6
1.4
1.2
1
0.8
0.6
74
75
76
77
78
79
GAGES
PHASE II



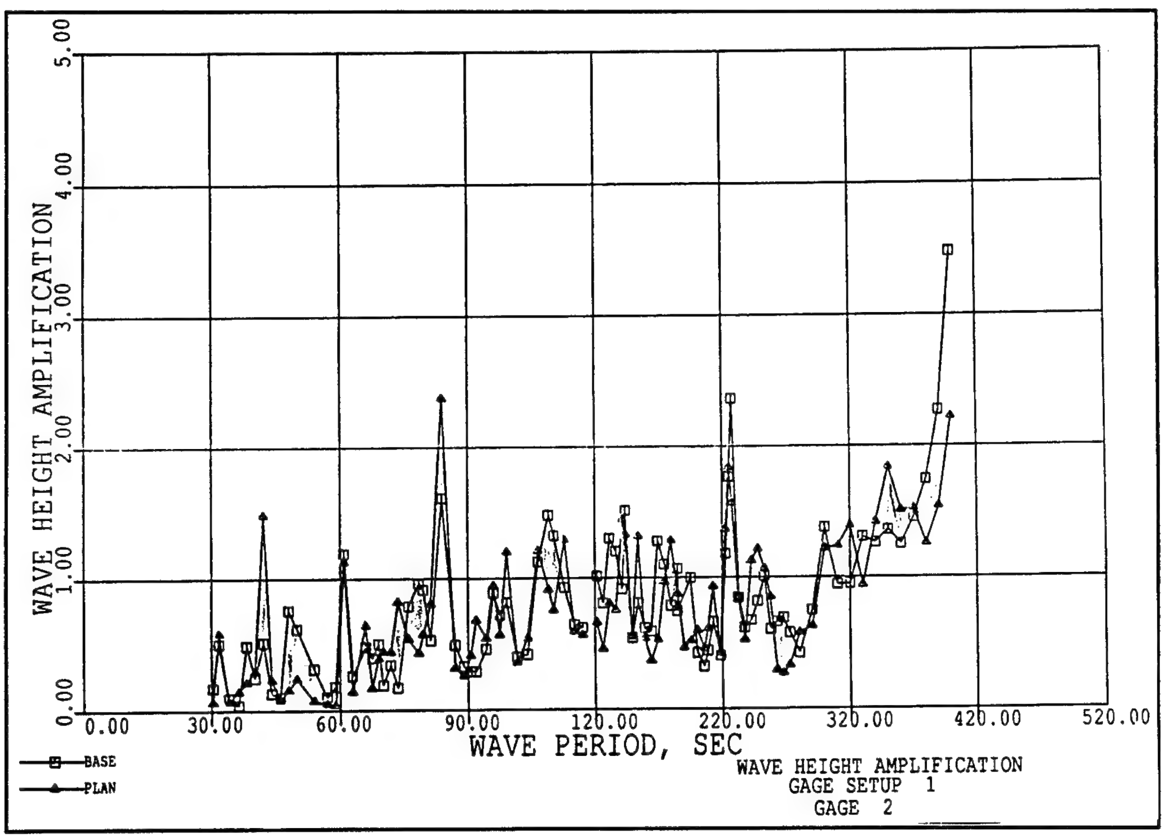
WAVE AMP AVERAGES FOR LA NEW
FEBRUARY SPECTRUM: 217-461 SEC PERIOD
WAVE HEIGHT AMP AVERAGES
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
74
75
76
77
78
79
GAGES
PHASE II


Plate 90

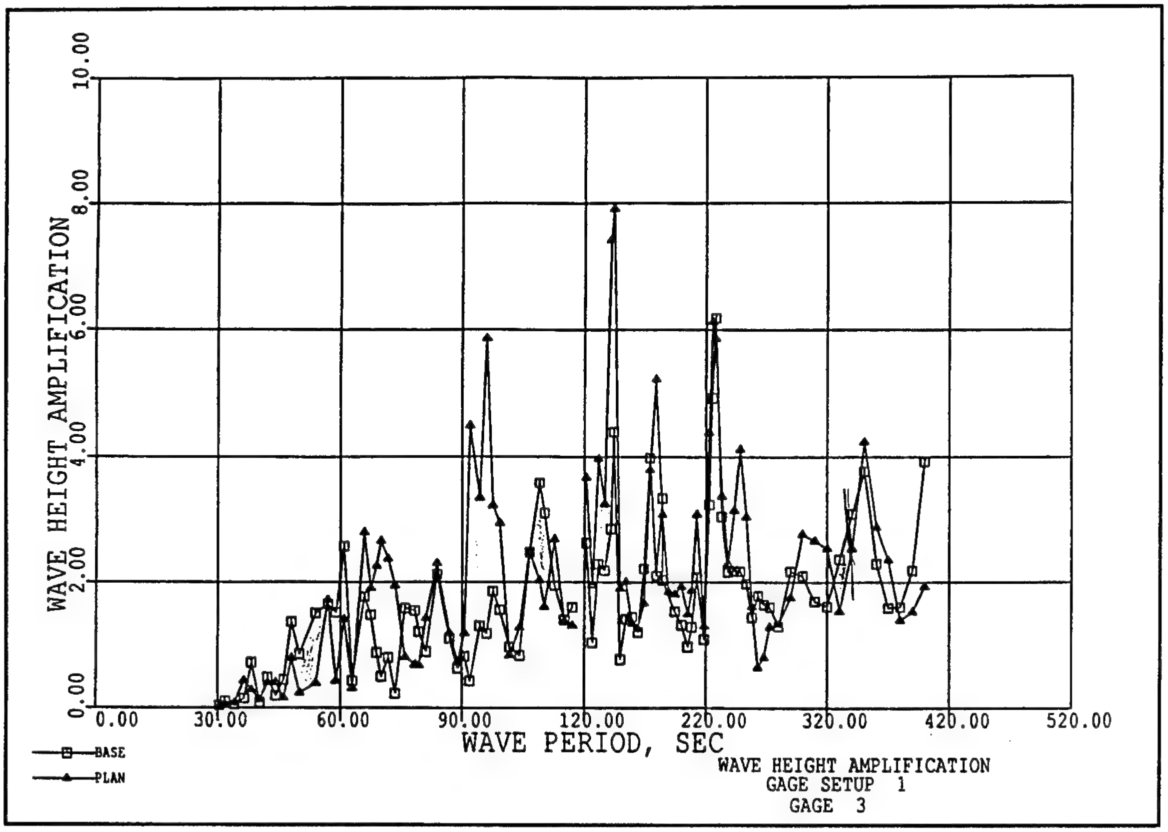
# Appendix A
# Monochromatic Water Test Results (Phase I, Scheme B)



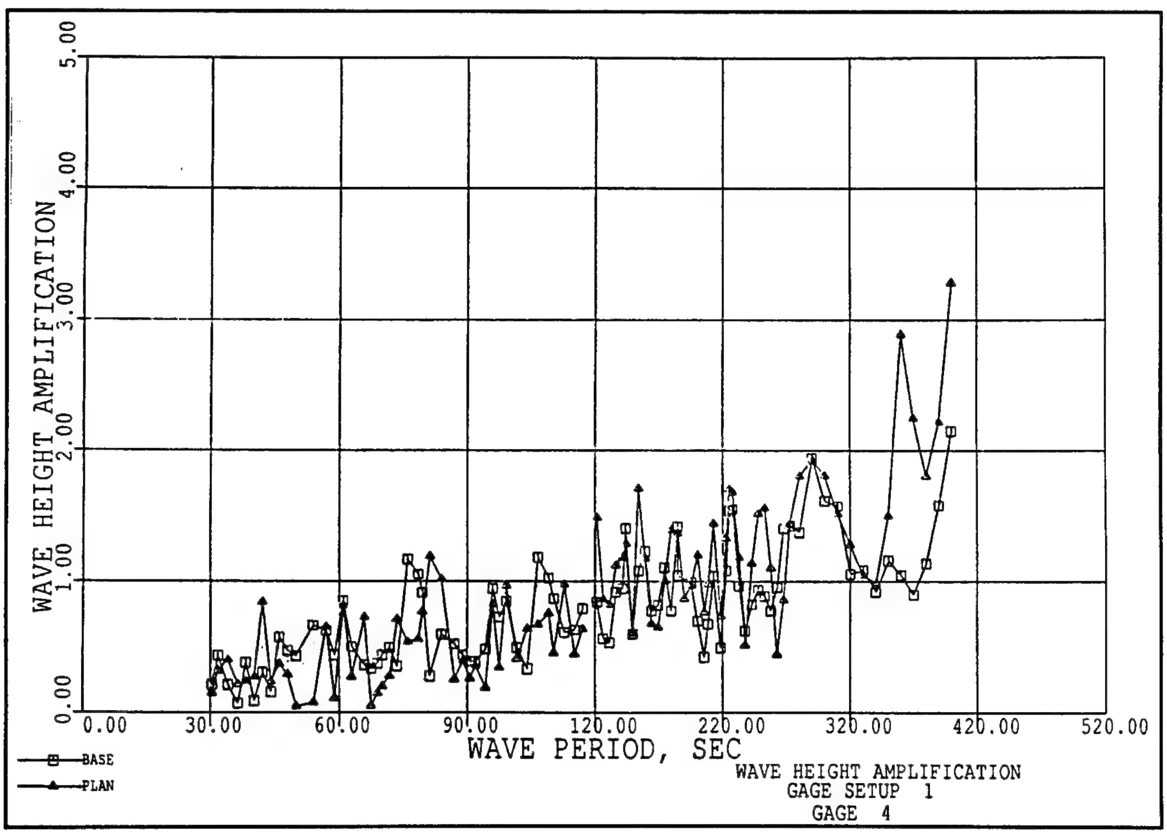
WAVE HEIGHT AMPLIFICATION
0.00
1.00
2.00
3.00
4.00
5.00
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 1
GAGE 1

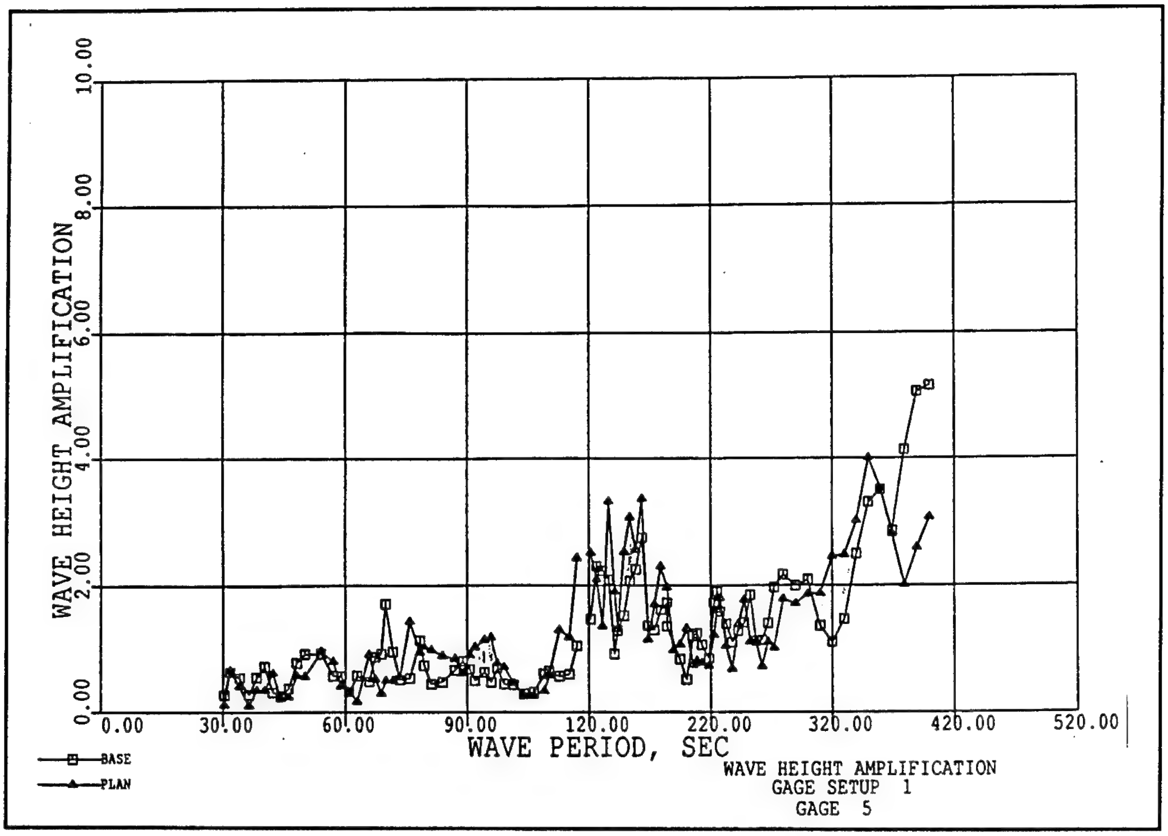
WAVE HEIGHT AMPLIFICATION
0.00
1.00
2.00
3.00
4.00
5.00
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 1
GAGE 2



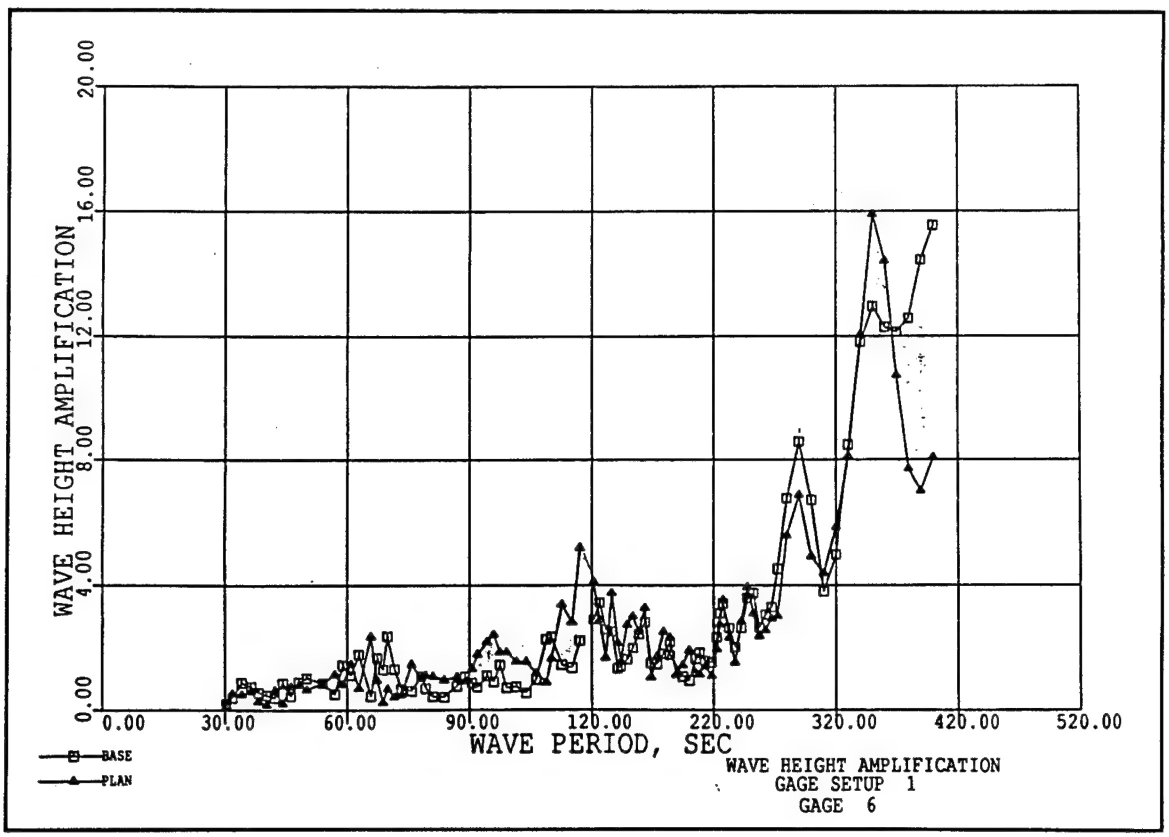
WAVE HEIGHT AMPLIFICATION
10.00
8.00
6.00
4.00
2.00
0.00
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 1
GAGE 3

WAVE HEIGHT AMPLIFICATION
5.00
4.00
3.00
2.00
1.00
0.00
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 1
GAGE 4



WAVE HEIGHT AMPLIFICATION
0.00
2.00
4.00
6.00
8.00
10.00
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 1
GAGE 5

WAVE HEIGHT AMPLIFICATION
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4.00
8.00
12.00
16.00
20.00
0.00
30.00
60.00
90.00
120.00
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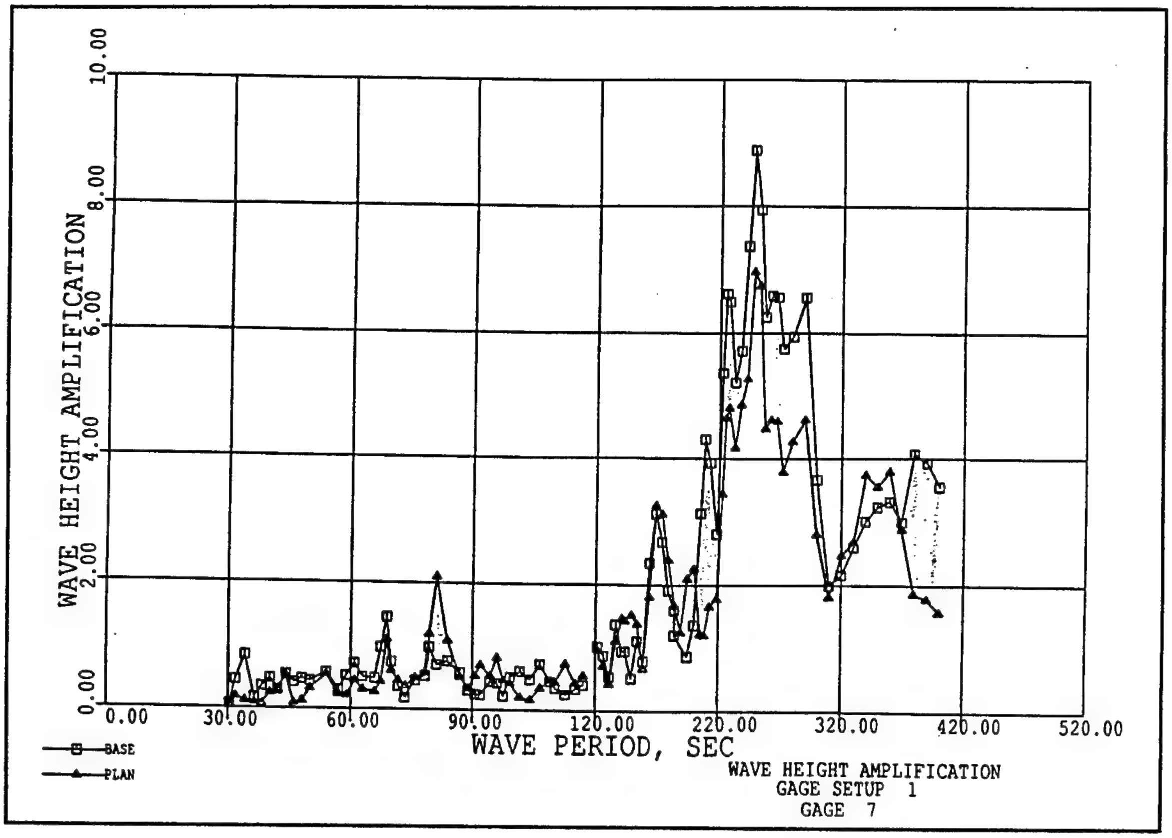
320.00
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 1
GAGE 6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10.00
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30.00
60.00
90.00
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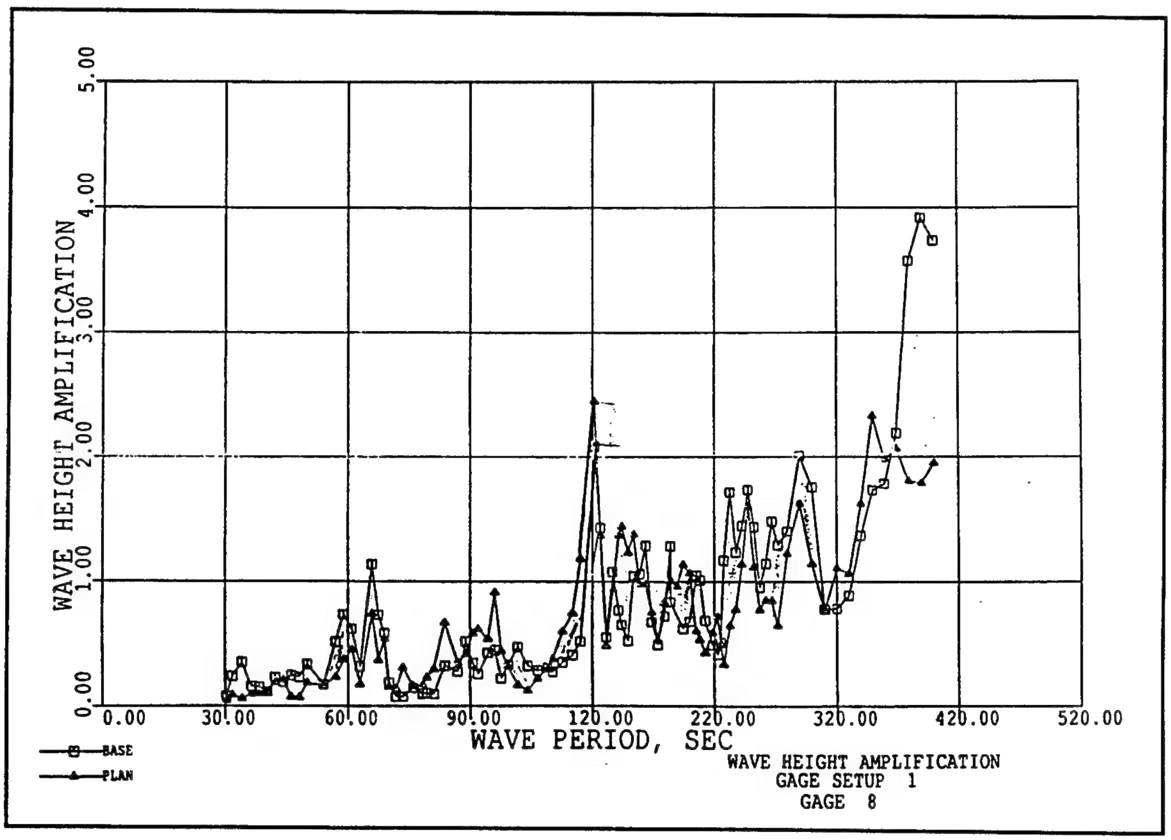
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 1
GAGE 7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5.00
0.00
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60.00
90.00
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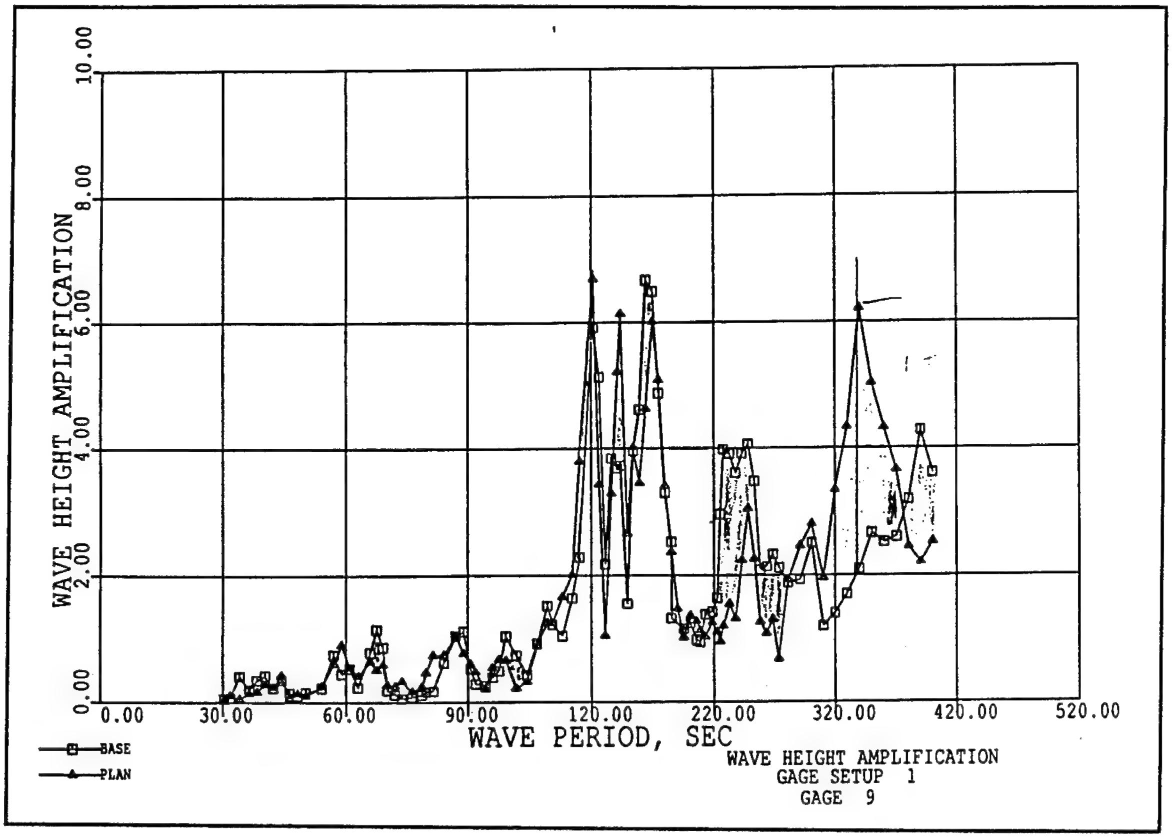
320.00
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 1
GAGE 8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6.00
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2.00
0.00
0.00
30.00
60.00
90.00
120.00
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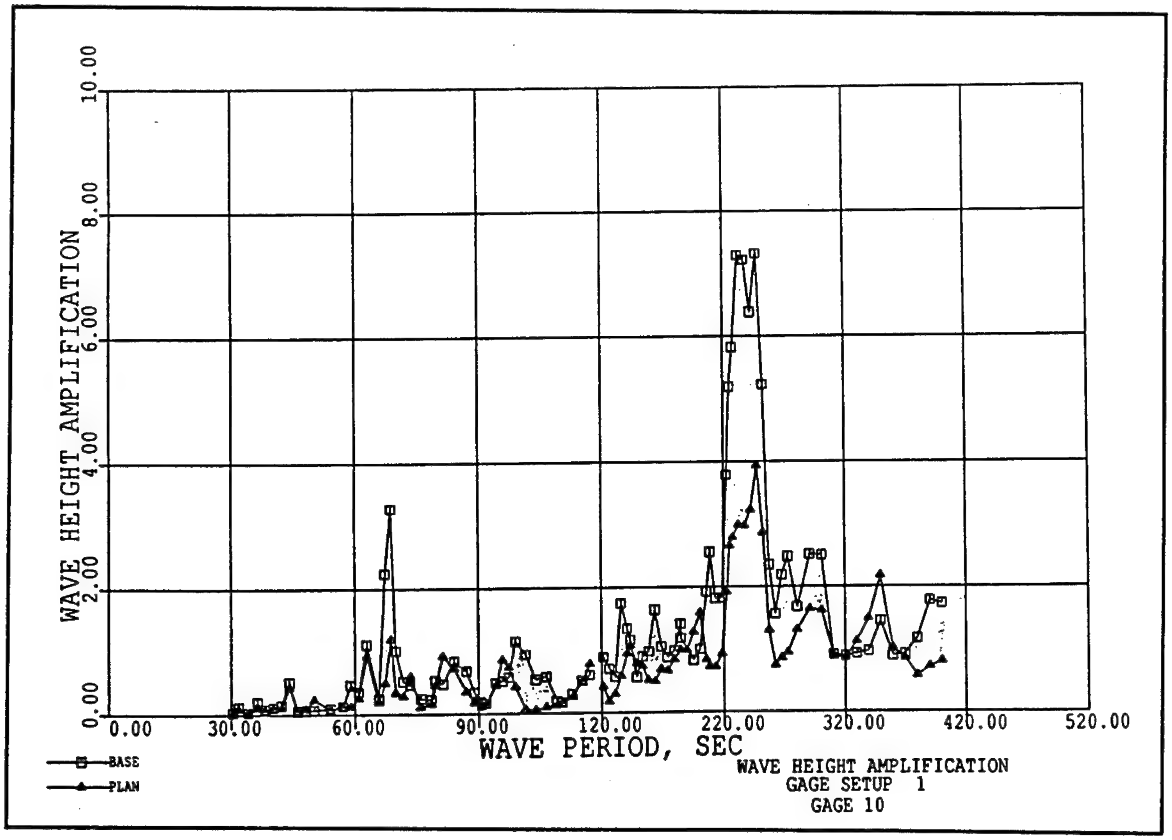
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 1
GAGE 9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90.00
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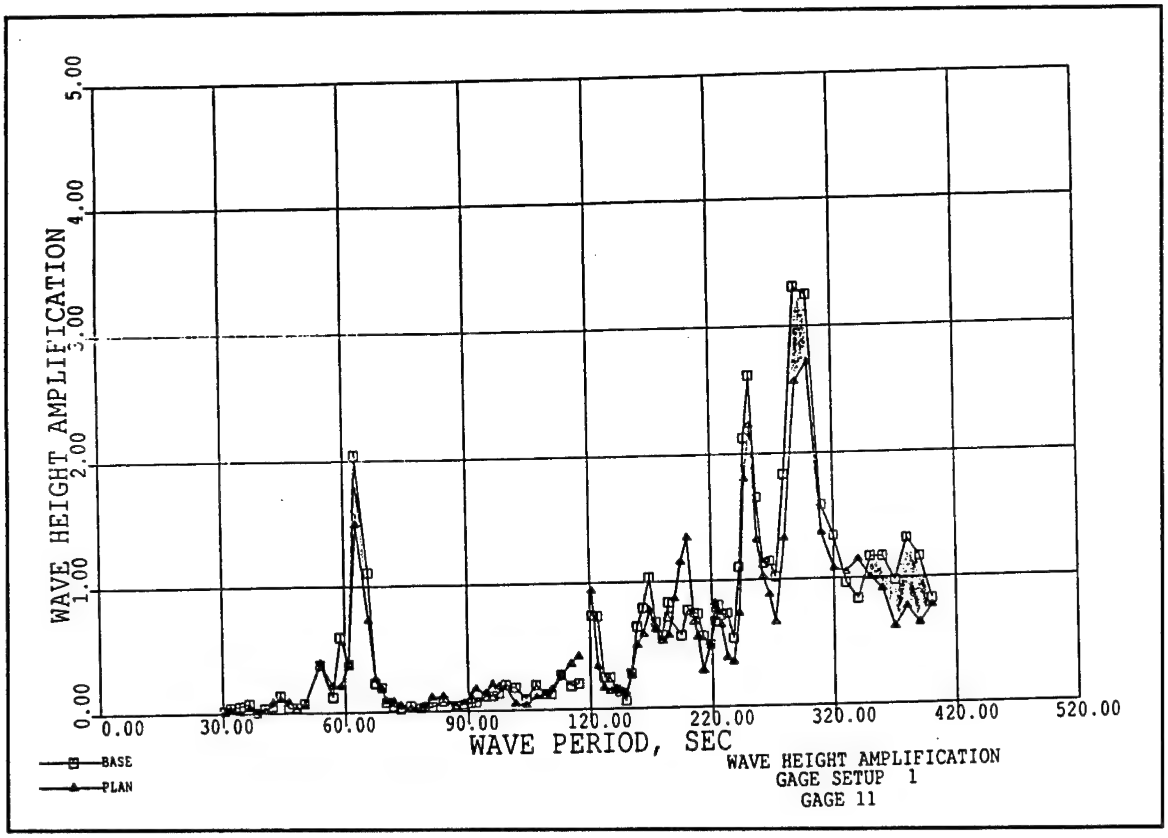
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 1
GAGE 10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0.00
WAVE HEIGHT AMPLIFICATION
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60.00
90.00
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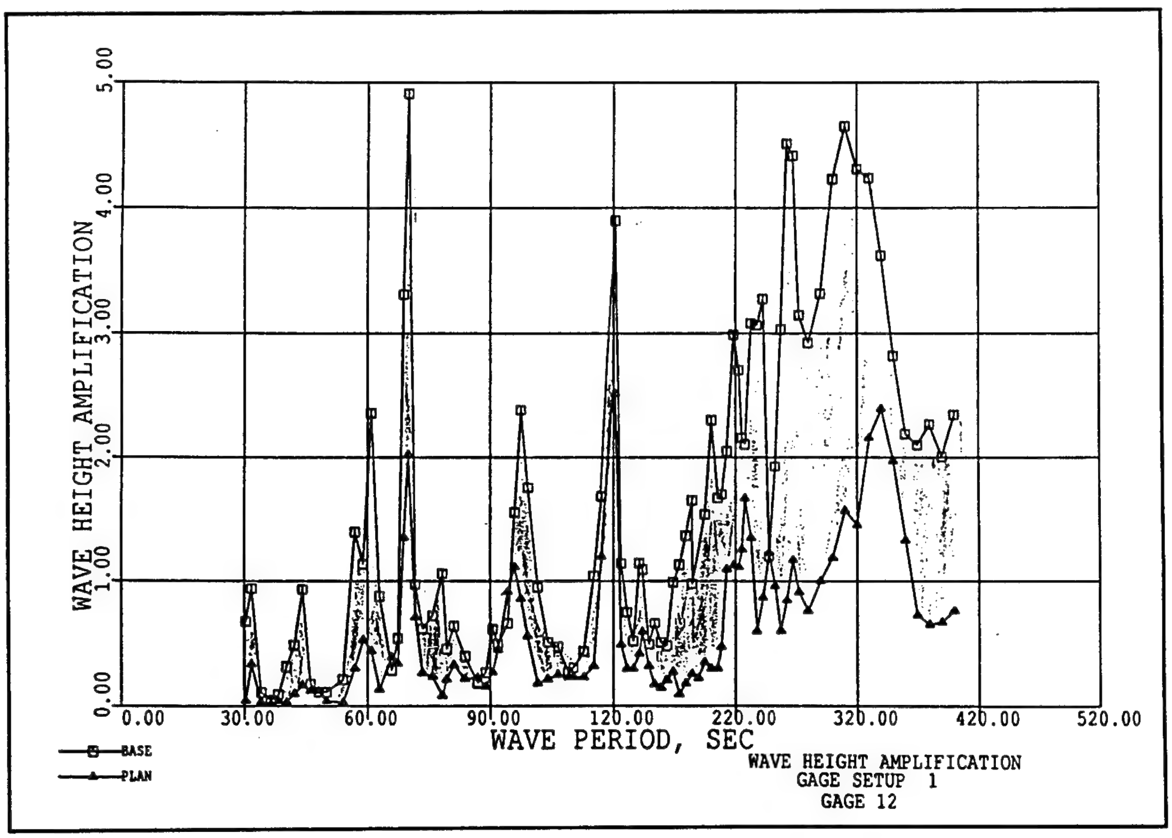
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 1
GAGE 11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WAVE HEIGHT AMPLIFICATION
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420.00
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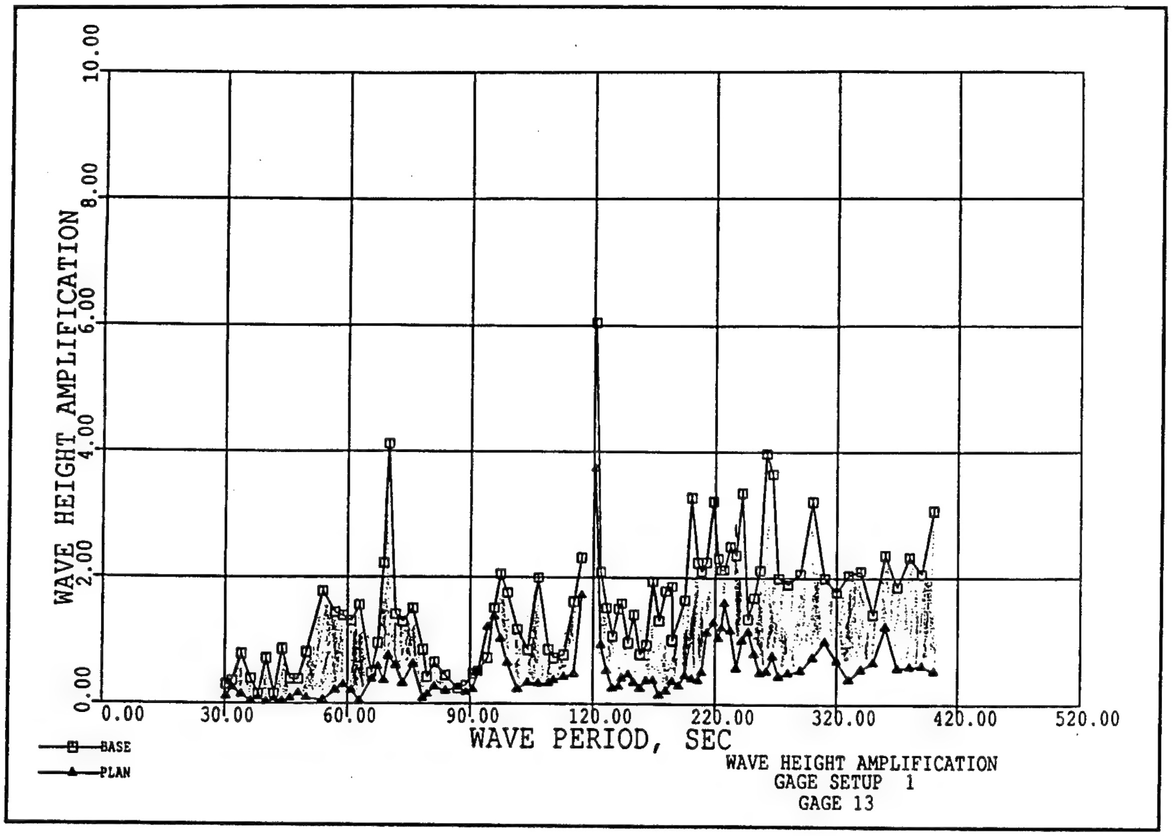
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 1
GAGE 12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60.00
90.00
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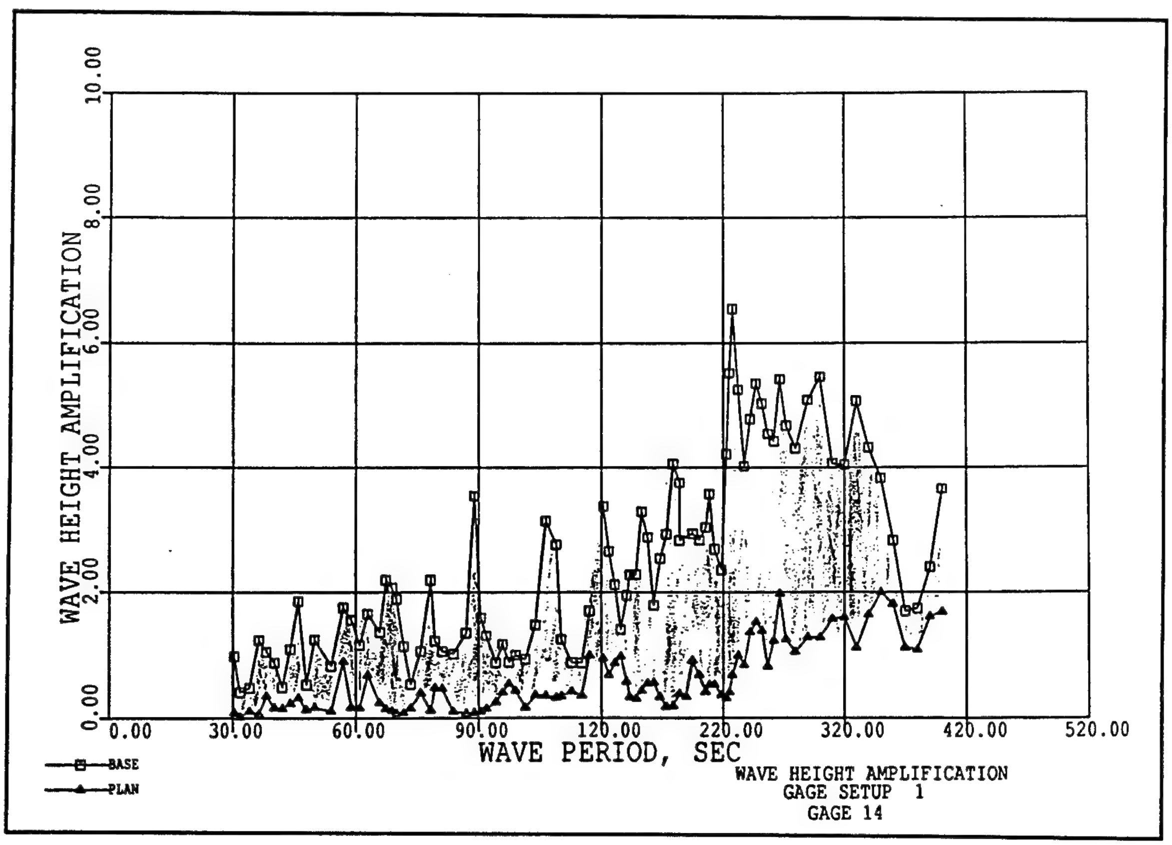
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 1
GAGE 13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60.00
90.00
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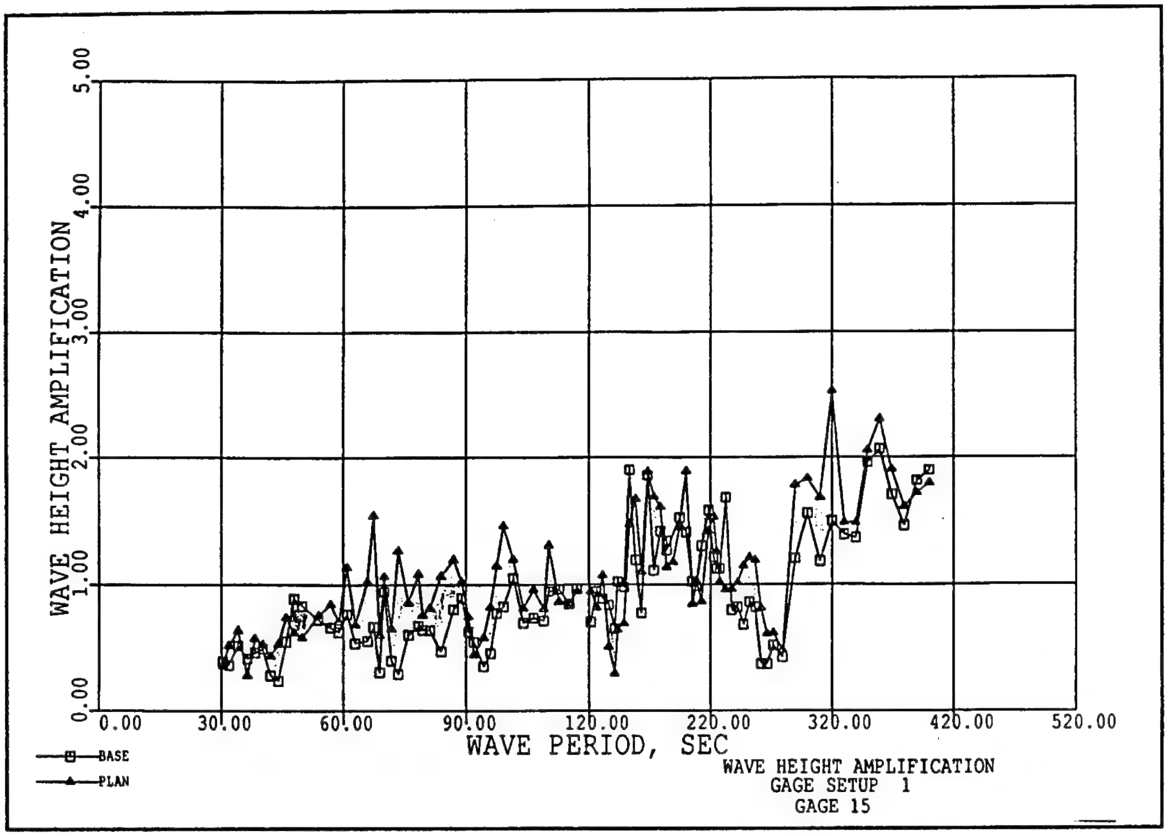
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 1
GAGE 14



WAVE HEIGHT AMPLIFICATION
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3.00
4.00
5.00
0.00
30.00
60.00
90.00
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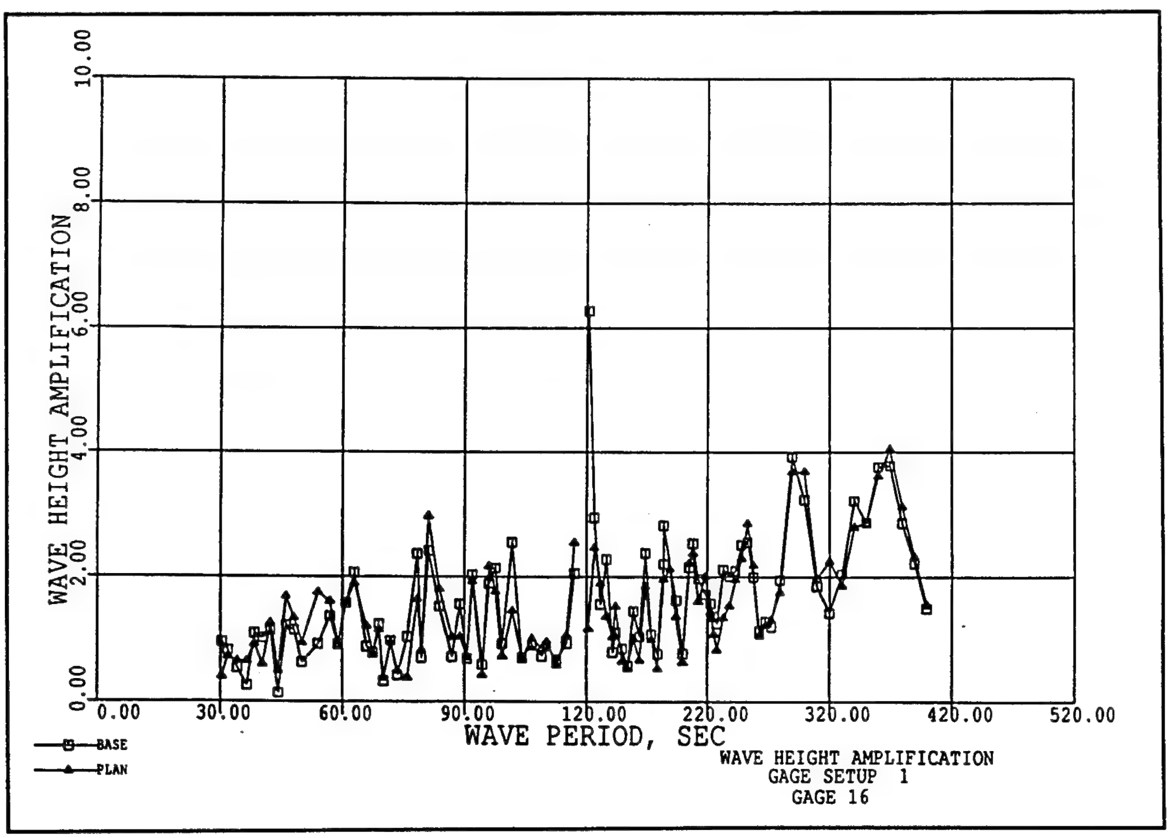
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 1
GAGE 15

WAVE HEIGHT AMPLIFICATION
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6.00
8.00
10.00
0.00
30.00
60.00
90.00
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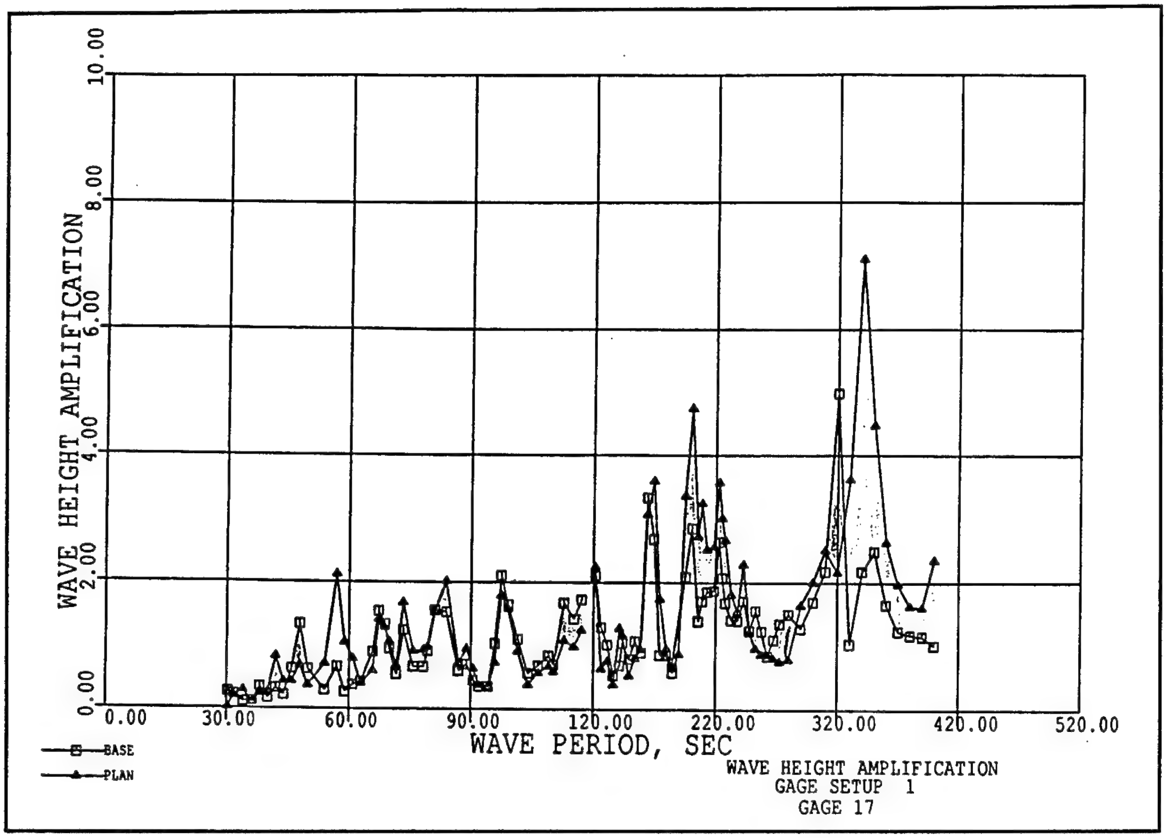
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 1
GAGE 16



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4.00
2.00
0.00
WAVE HEIGHT AMPLIFICATION
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30.00
60.00
90.00
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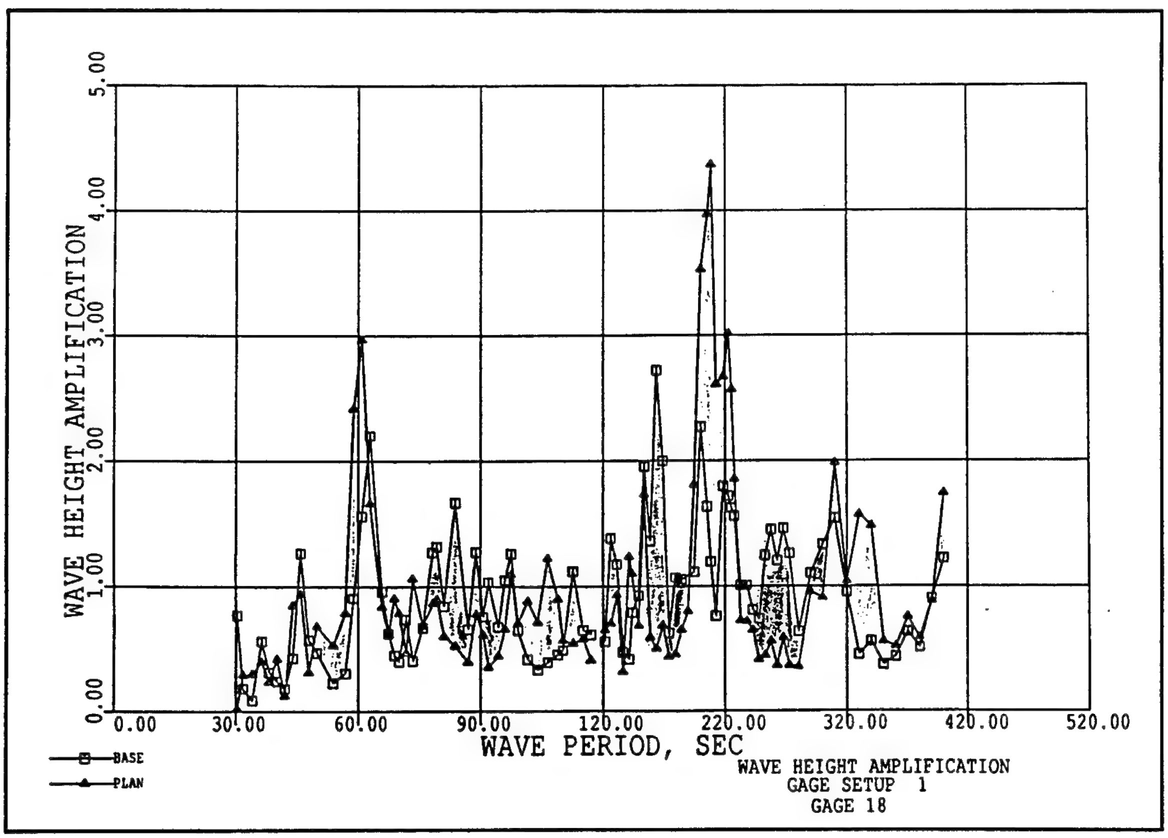
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 1
GAGE 17

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WAVE HEIGHT AMPLIFICATION
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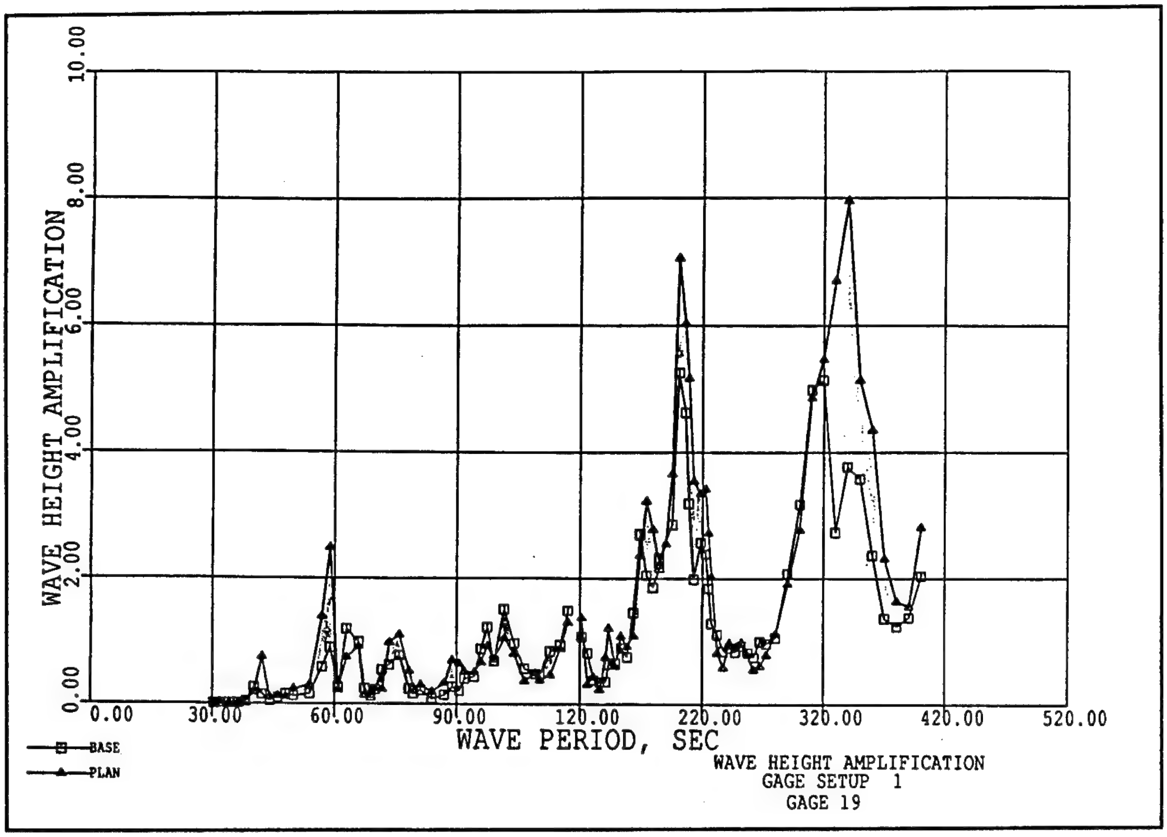
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 1
GAGE 18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4.00
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WAVE HEIGHT AMPLIFICATION
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90.00
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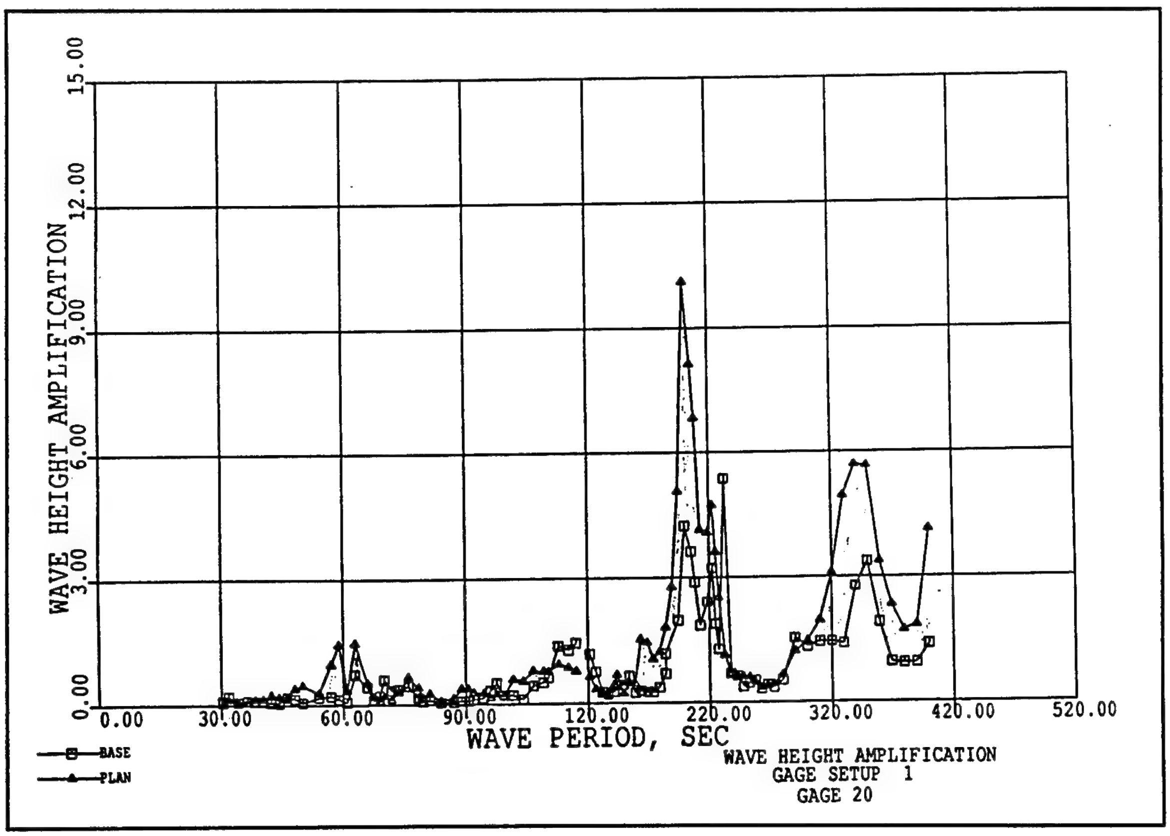
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 1
GAGE 19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WAVE HEIGHT AMPLIFICATION
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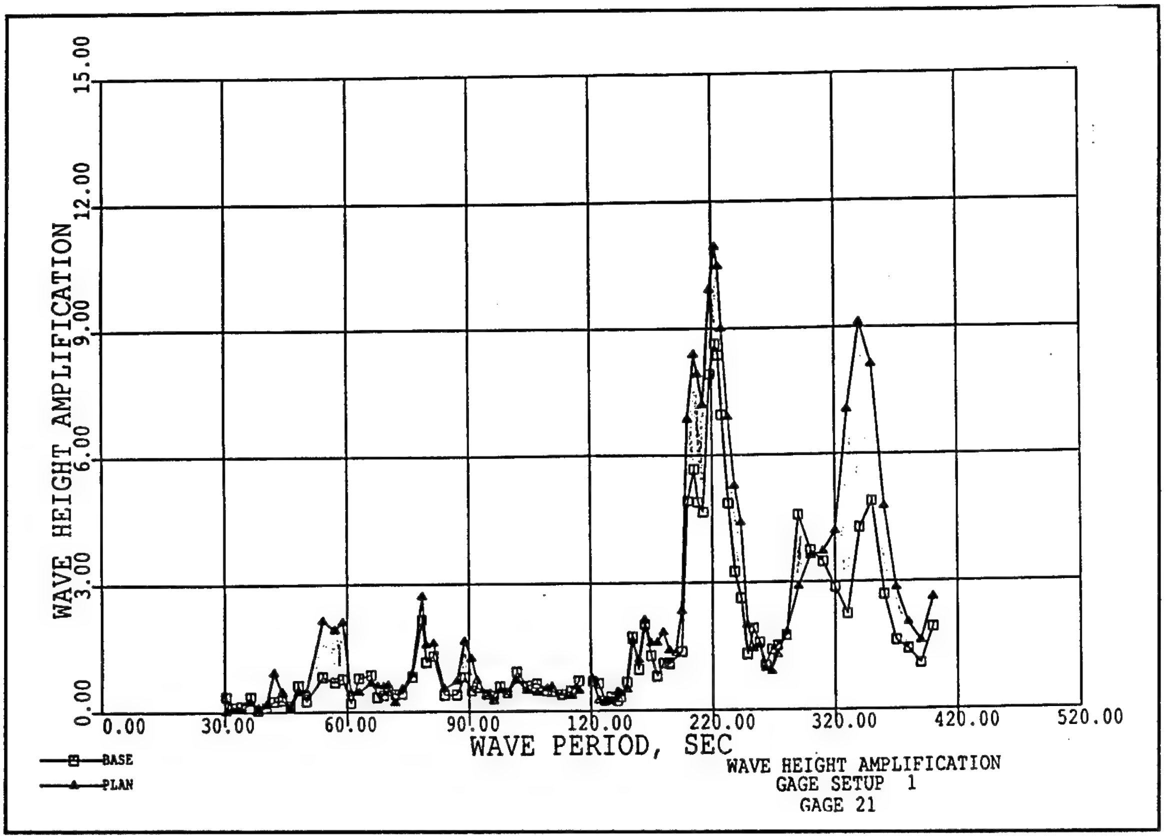
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 1
GAGE 20


WAVE HEIGHT AMPLIFICATION
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30.00
60.00
90.00
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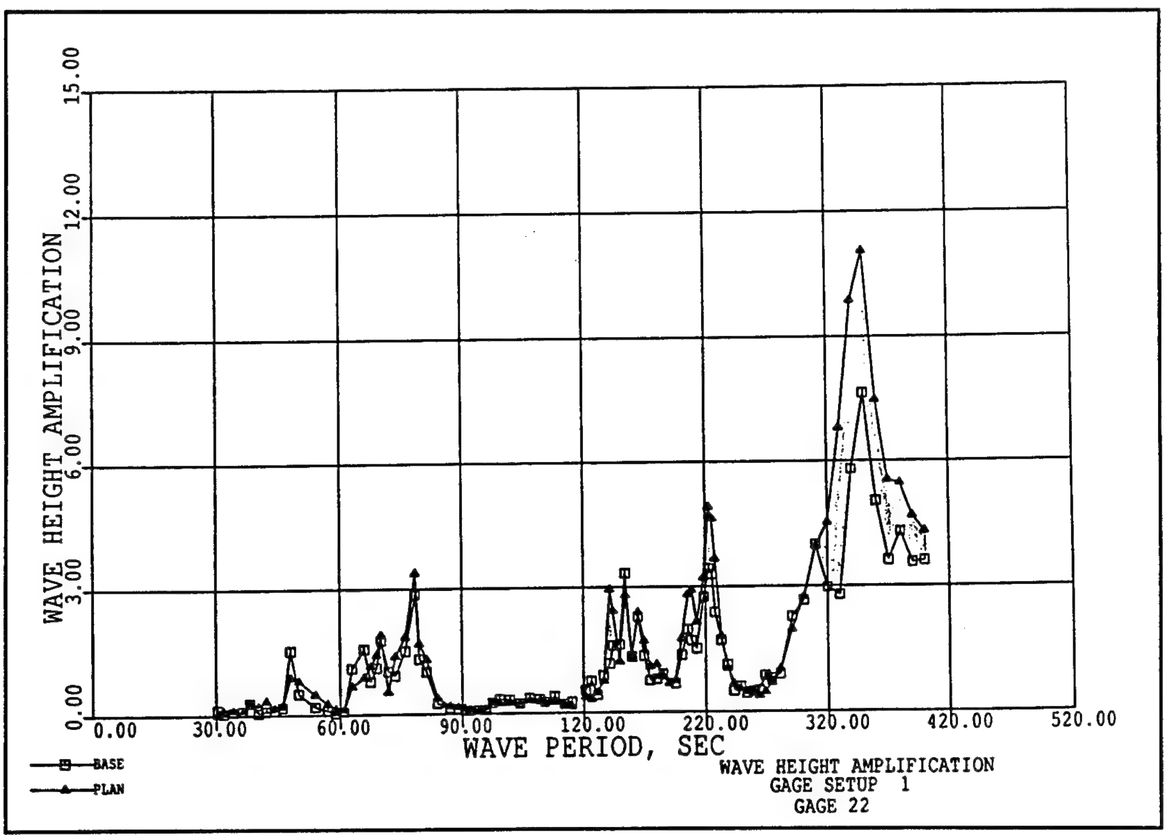
320.00
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 1
GAGE 21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30.00
60.00
90.00
120.00
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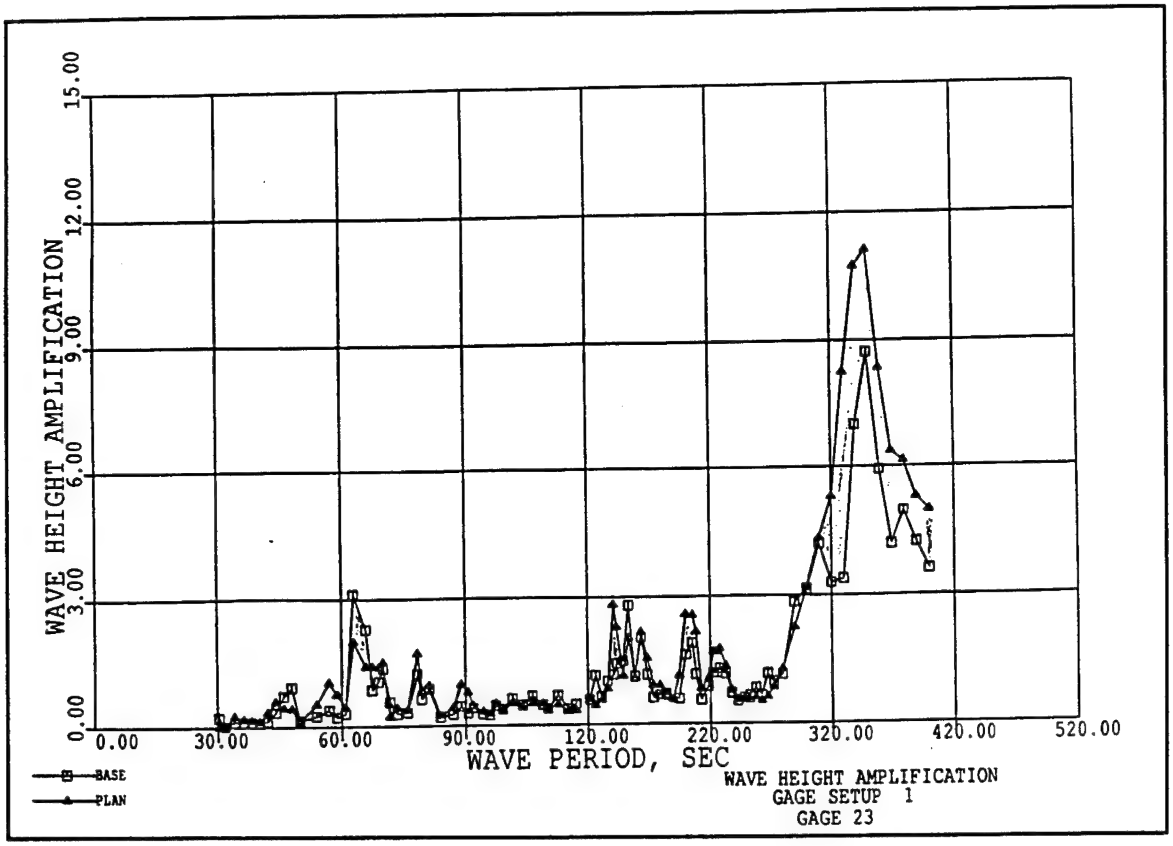
320.00
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 1
GAGE 22



WAVE HEIGHT AMPLIFICATION
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60.00
90.00
120.00
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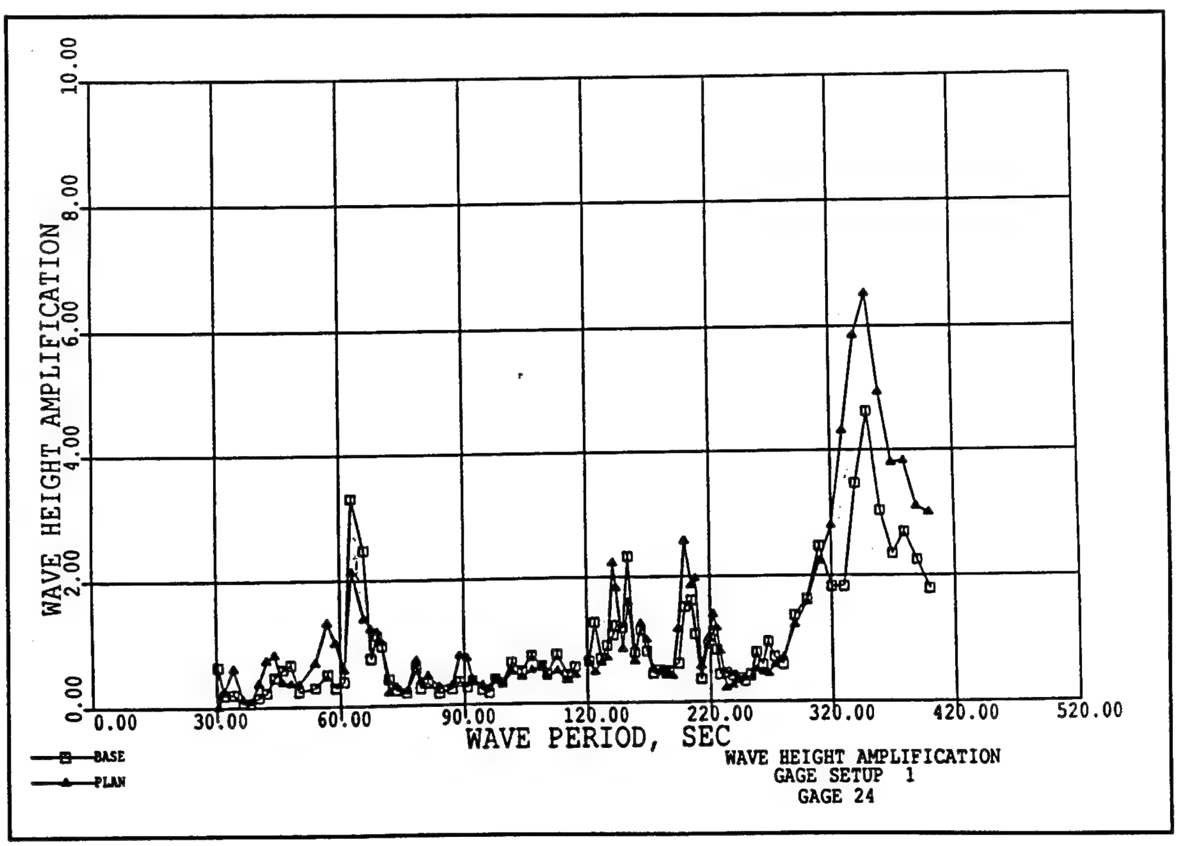
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 1
GAGE 23

WAVE HEIGHT AMPLIFICATION
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30.00
60.00
90.00
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520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 1
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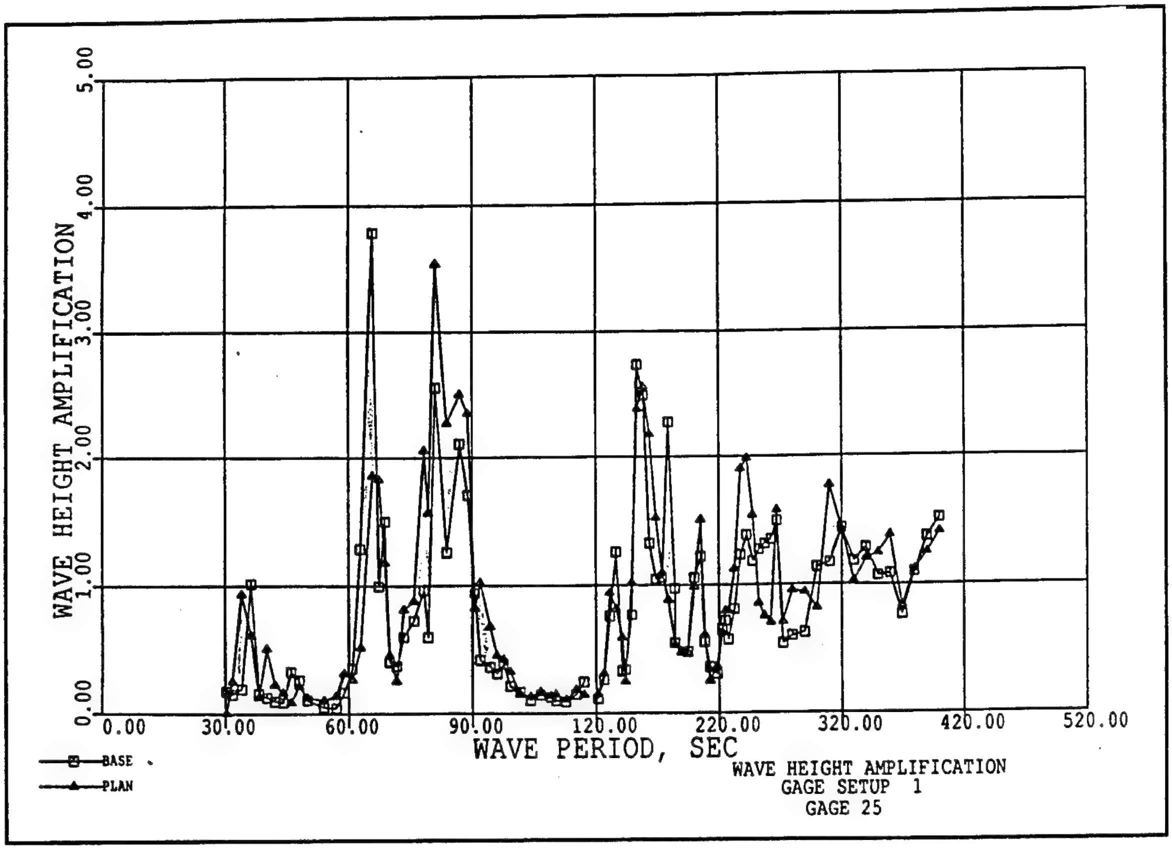
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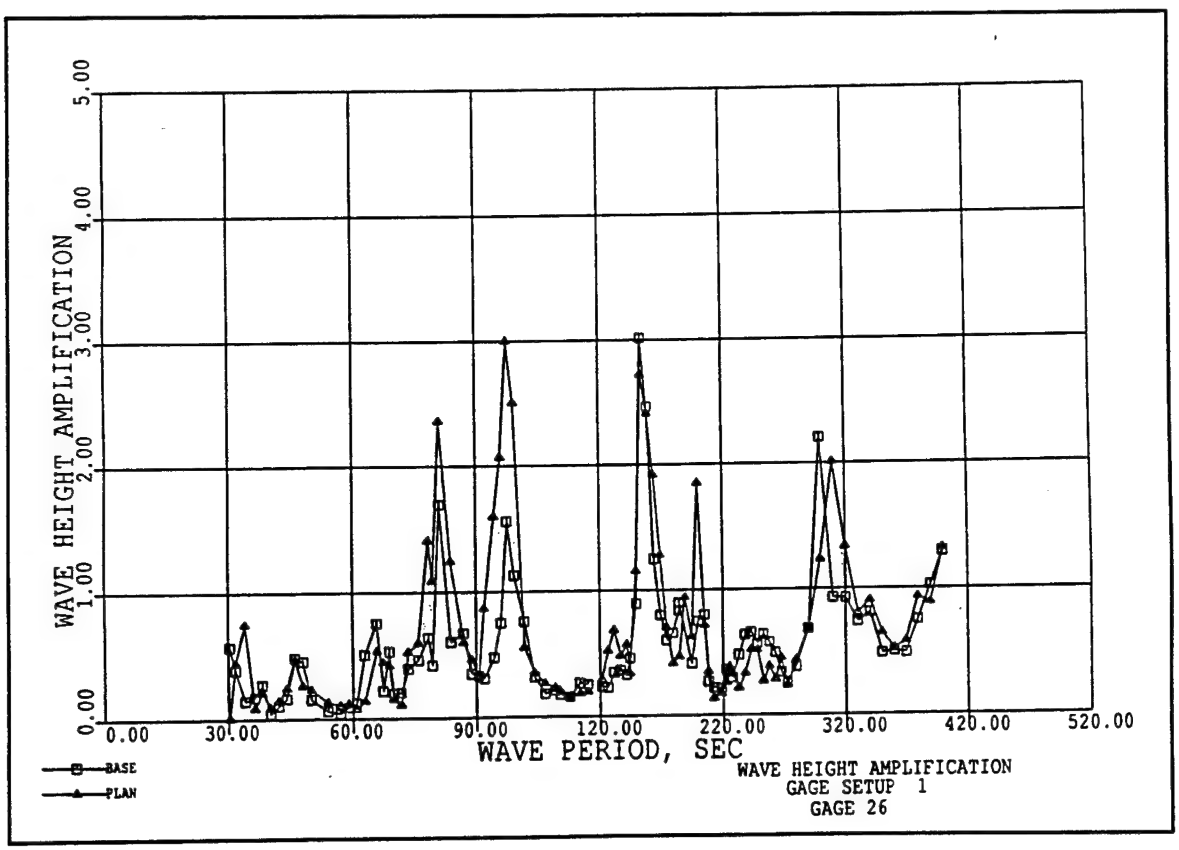
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 1
GAGE 25


WAVE HEIGHT AMPLIFICATION
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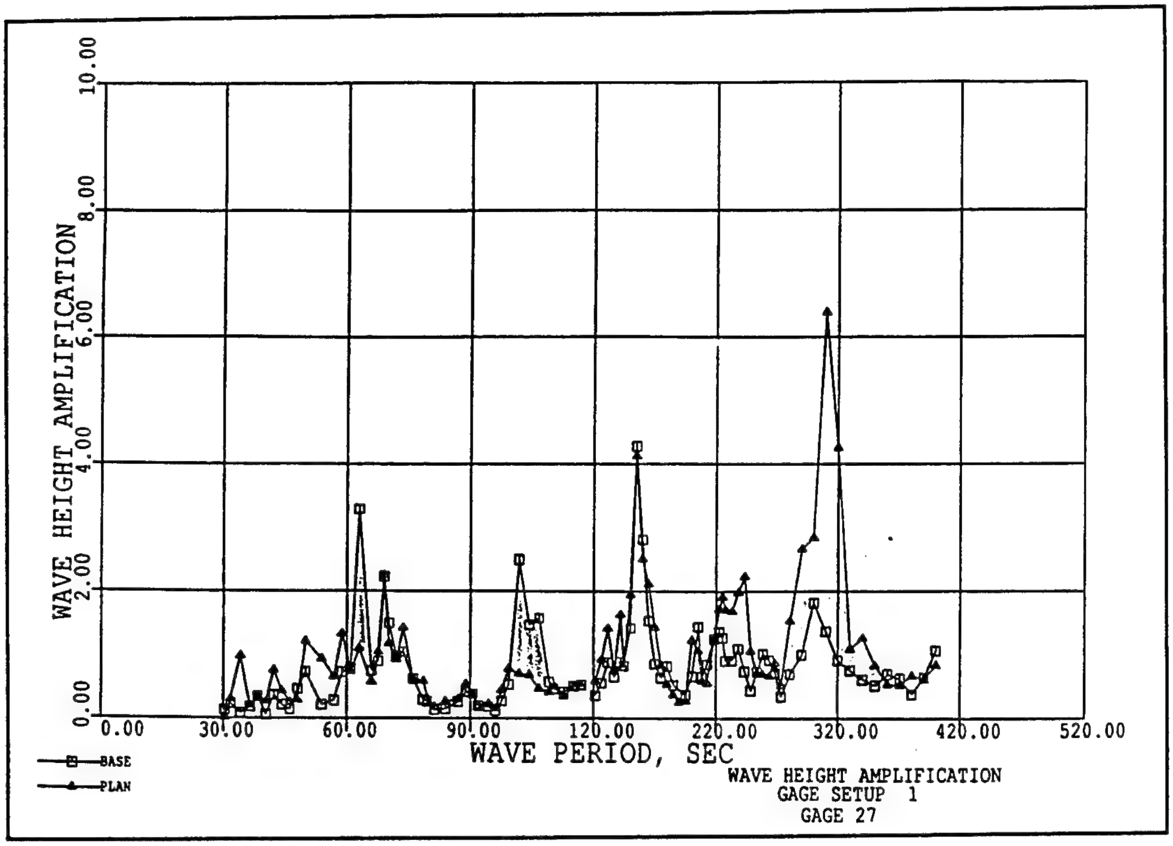
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 1
GAGE 26



WAVE HEIGHT AMPLIFICATION
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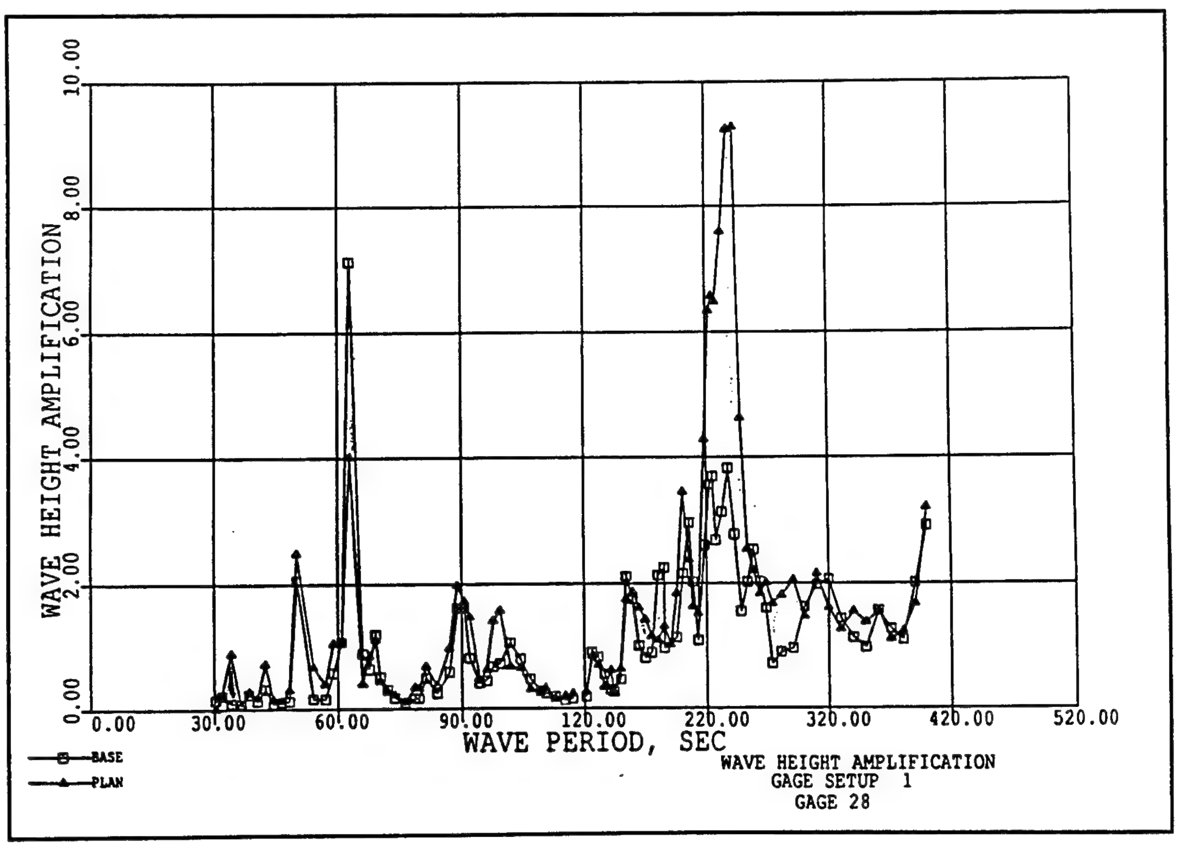
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 1
GAGE 27

WAVE HEIGHT AMPLIFICATION
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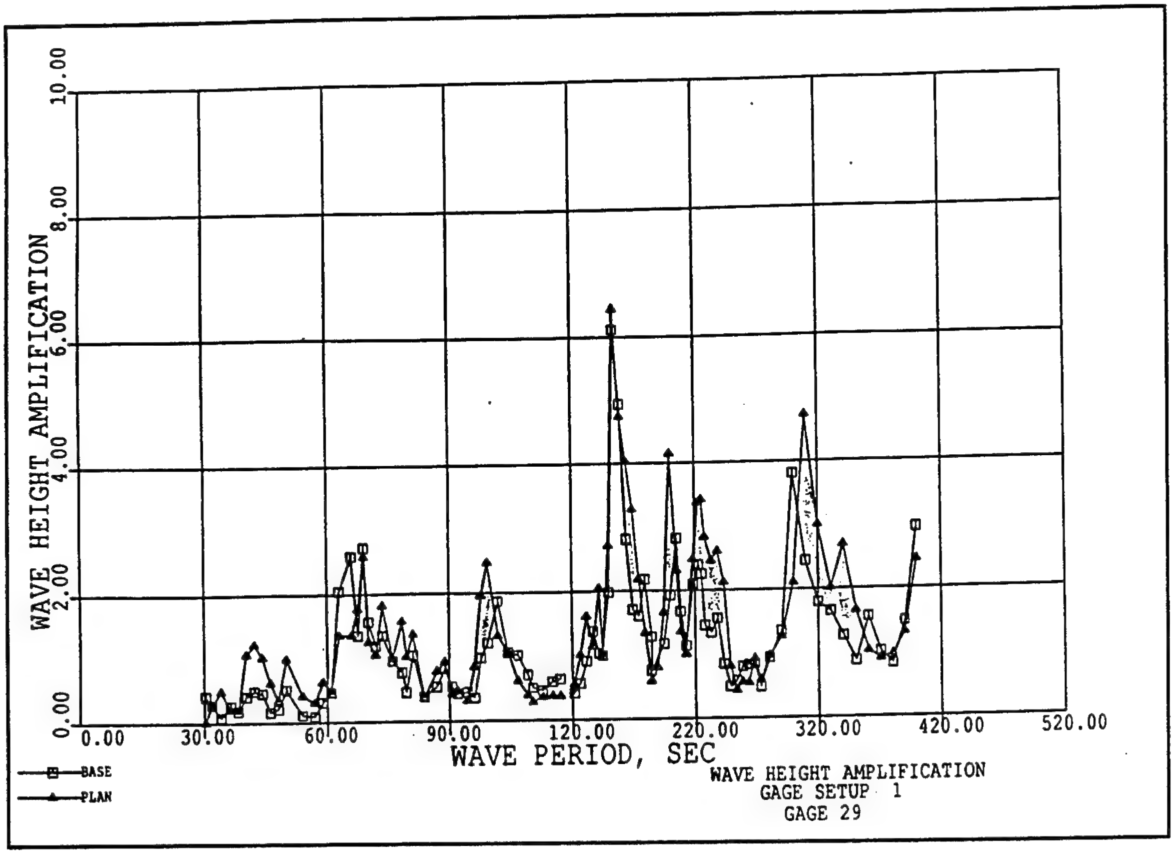
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 1
GAGE 28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WAVE HEIGHT AMPLIFICATION
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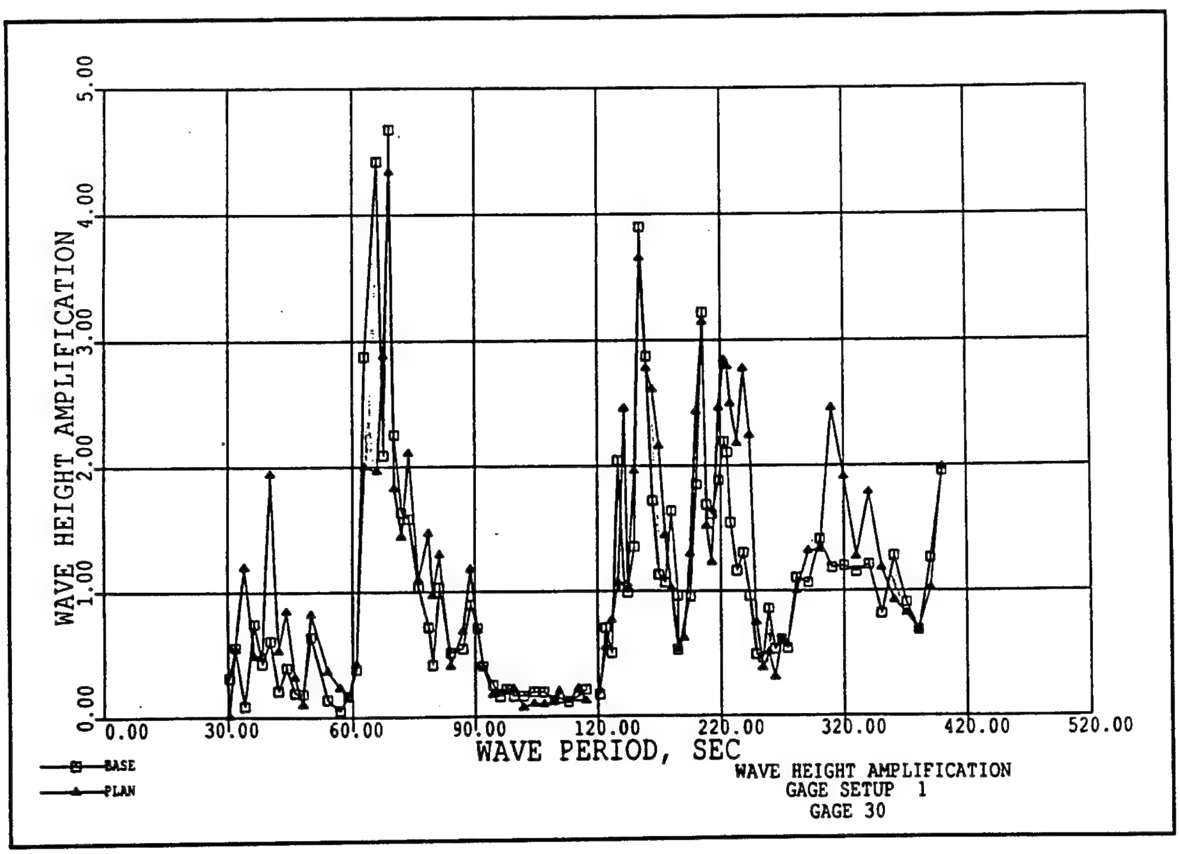
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 1
GAGE 29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0.00
WAVE HEIGHT AMPLIFICATION
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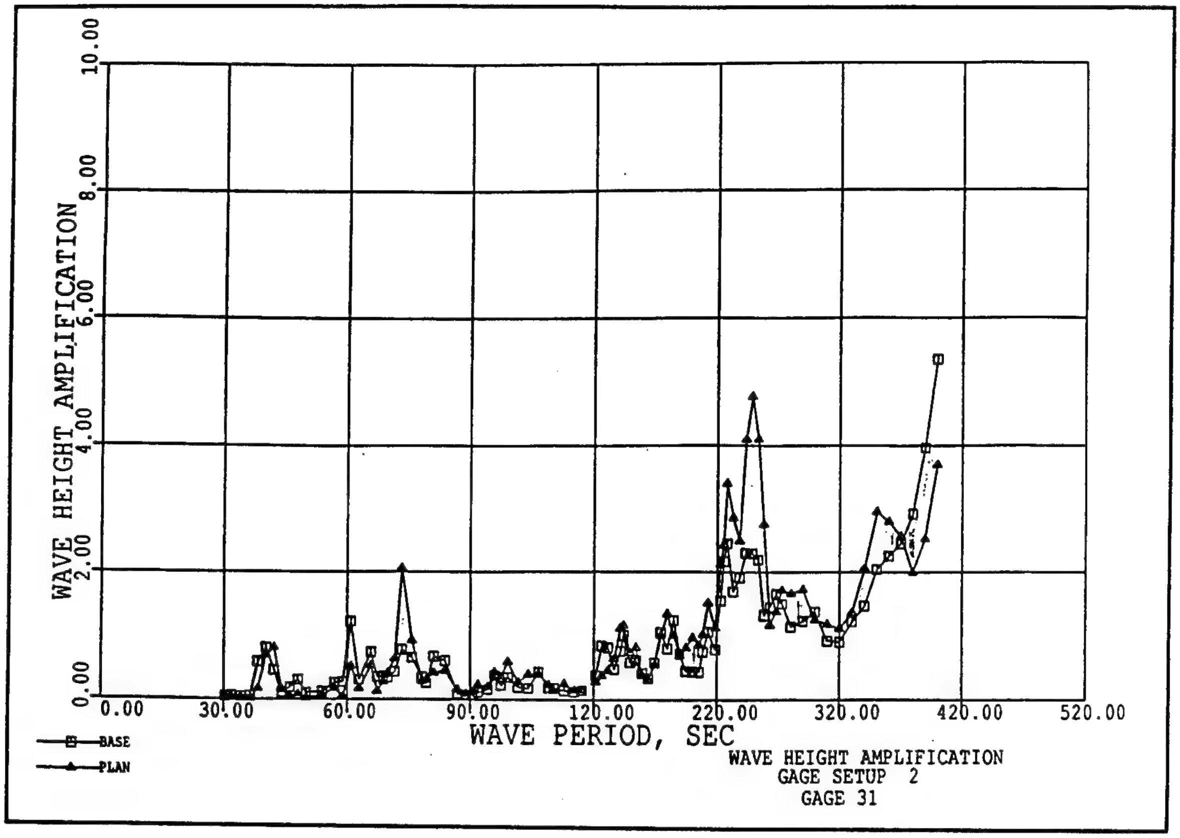
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 1
GAGE 30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WAVE HEIGHT AMPLIFICATION
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90.00
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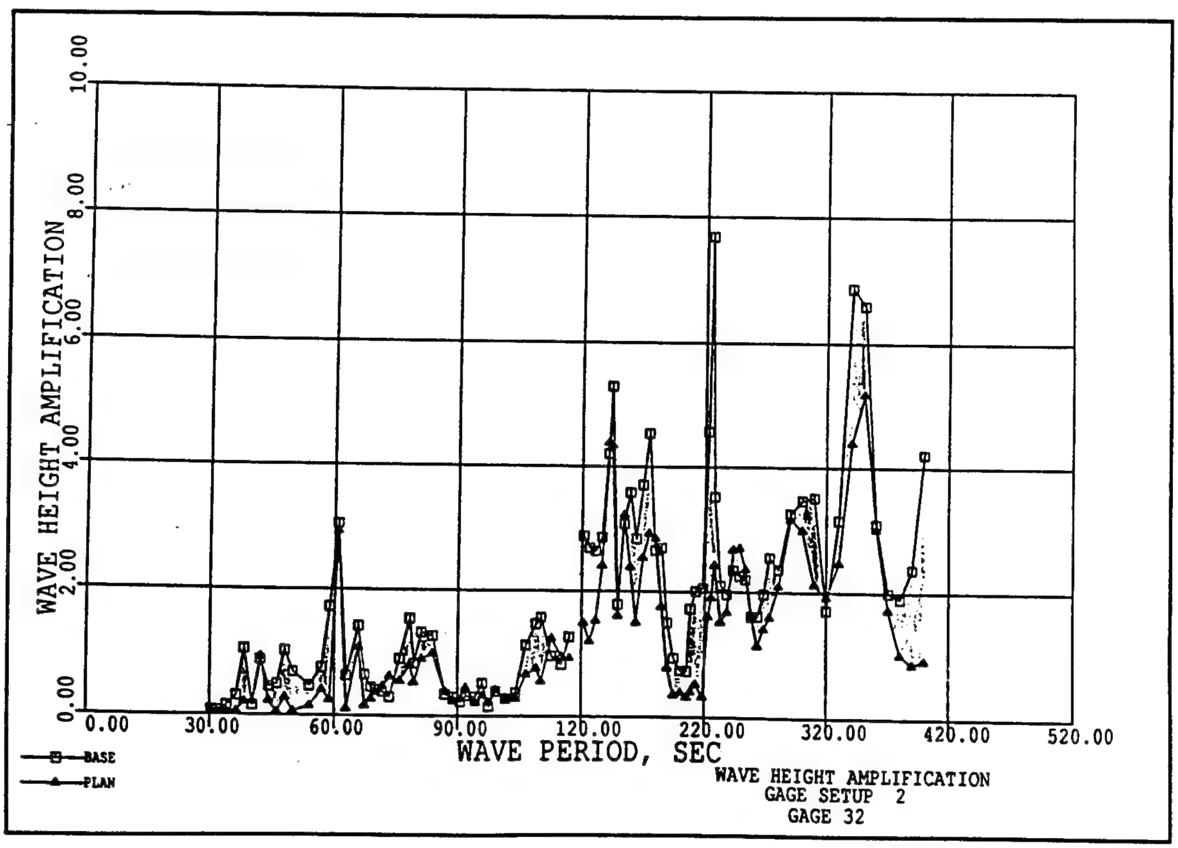
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 2
GAGE 31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WAVE HEIGHT AMPLIFICATION
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30.00
60.00
90.00
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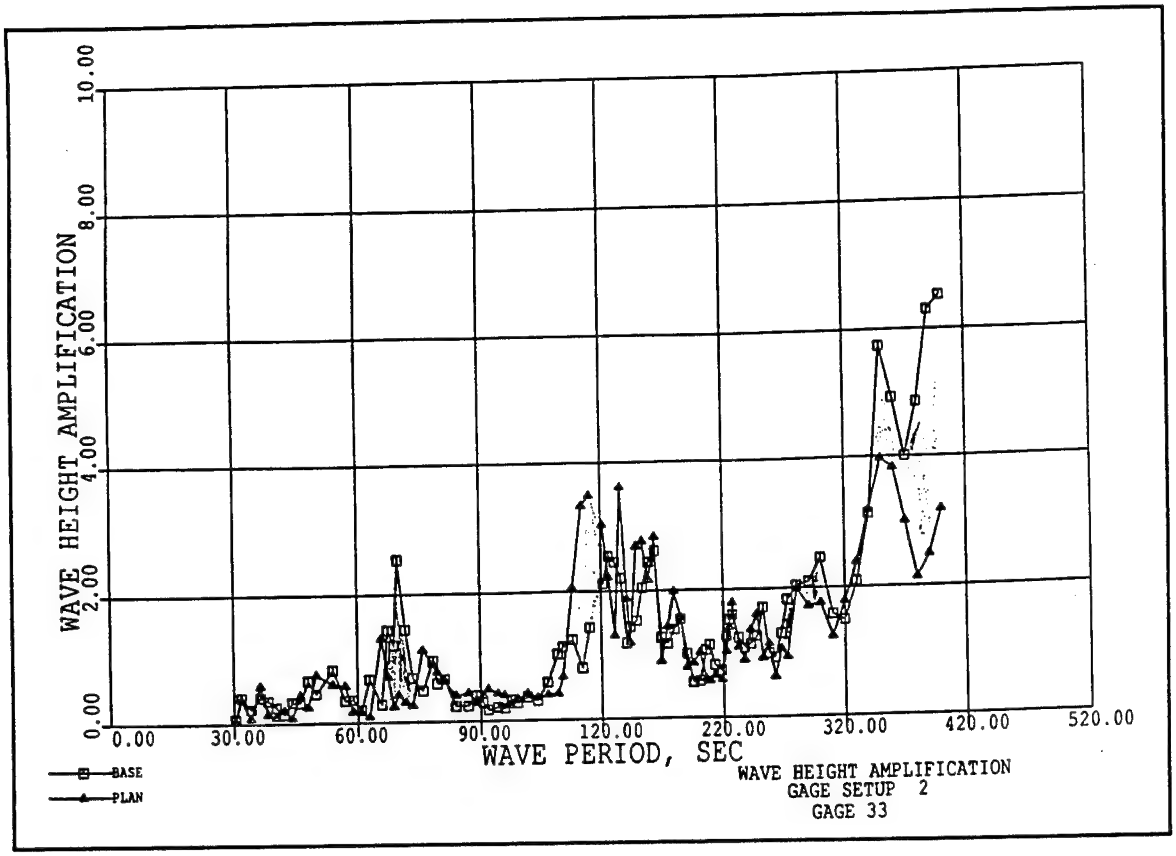
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 2
GAGE 32


WAVE HEIGHT AMPLIFICATION
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0.00
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30.00
60.00
90.00
120.00
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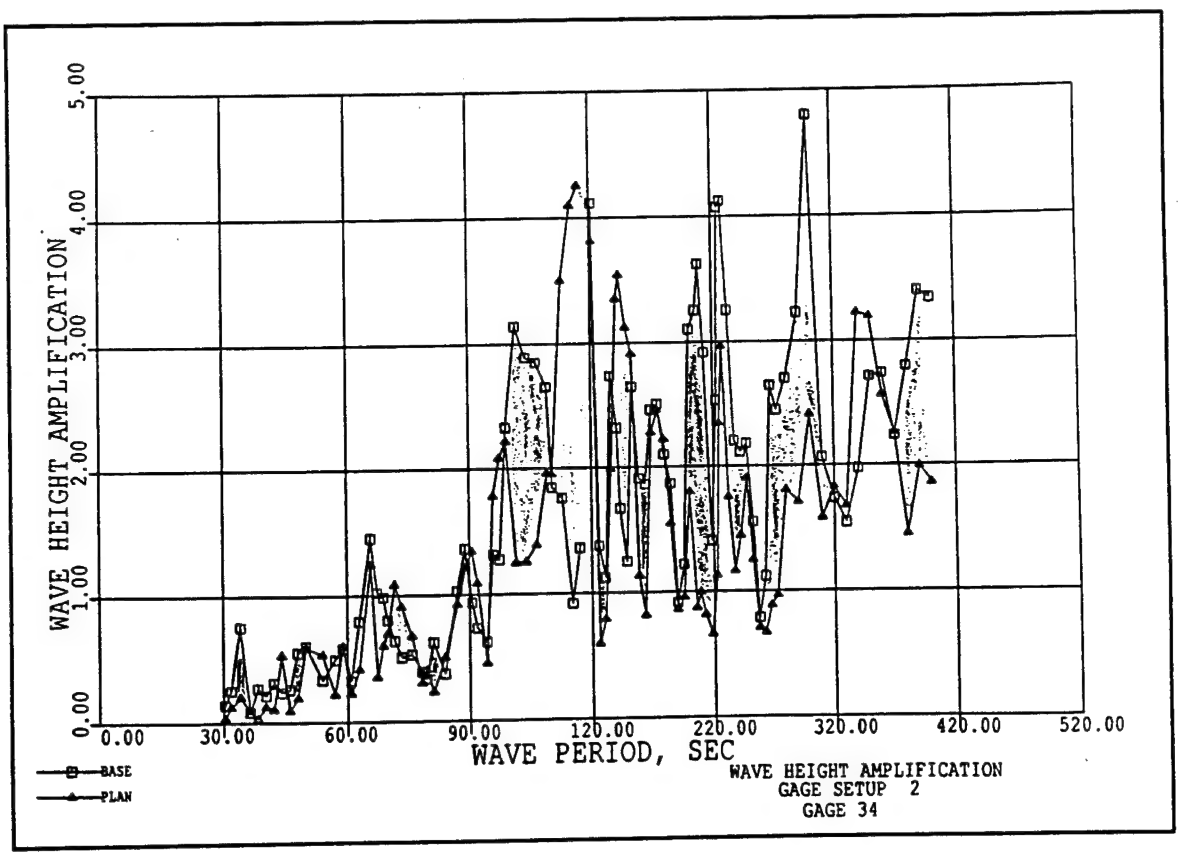
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 2
GAGE 33


WAVE HEIGHT AMPLIFICATION
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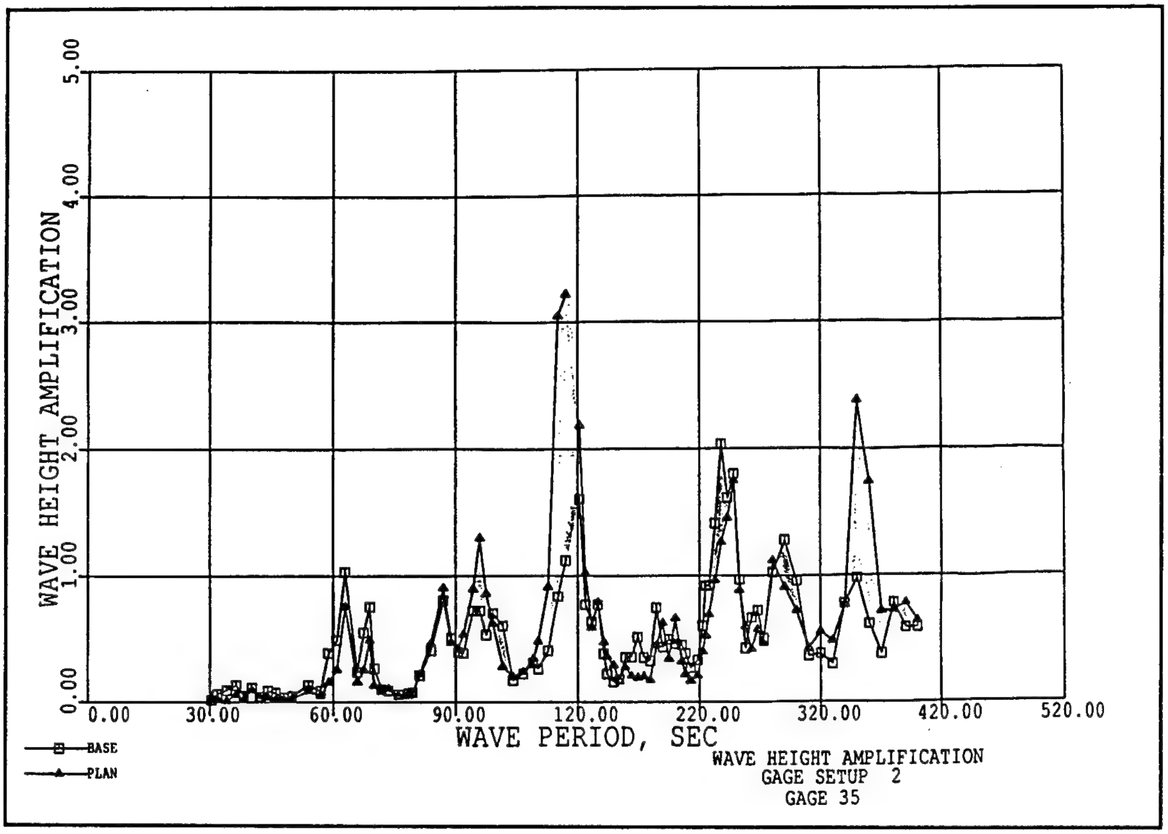
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 2
GAGE 34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WAVE HEIGHT AMPLIFICATION
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90.00
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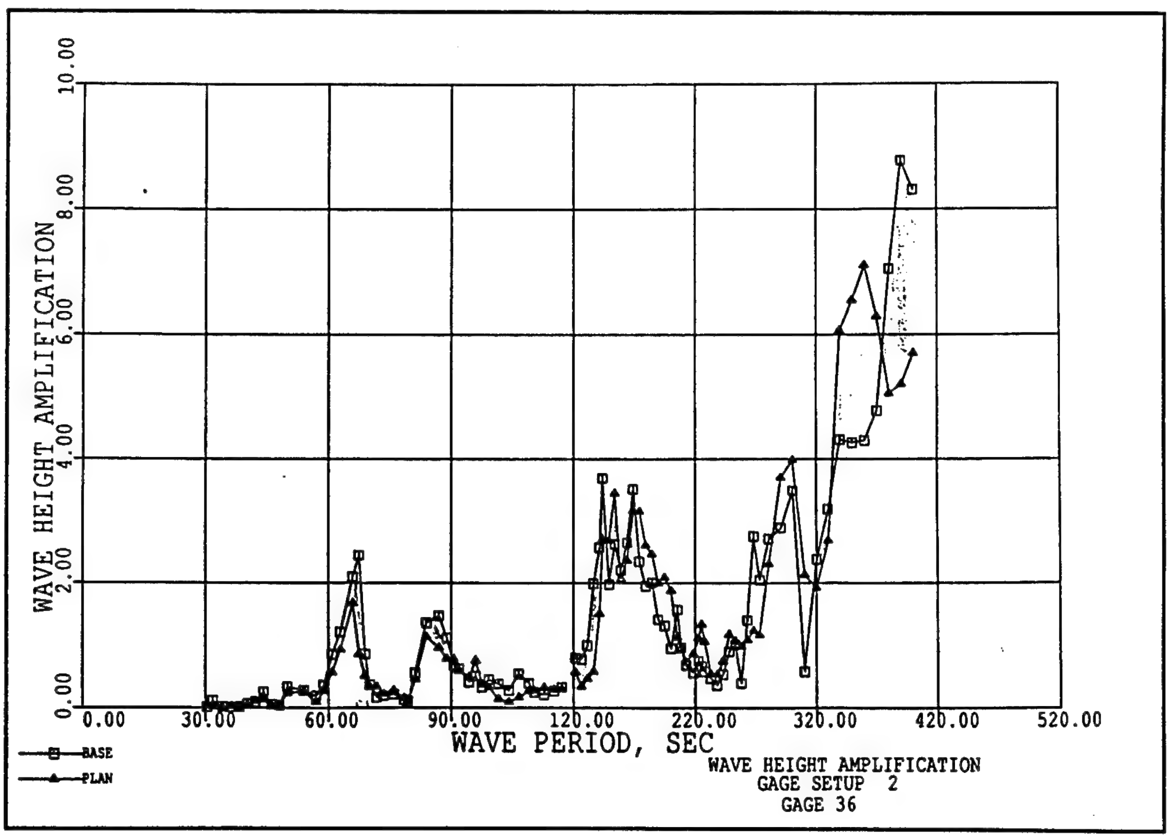
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 2
GAGE 35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WAVE HEIGHT AMPLIFICATION
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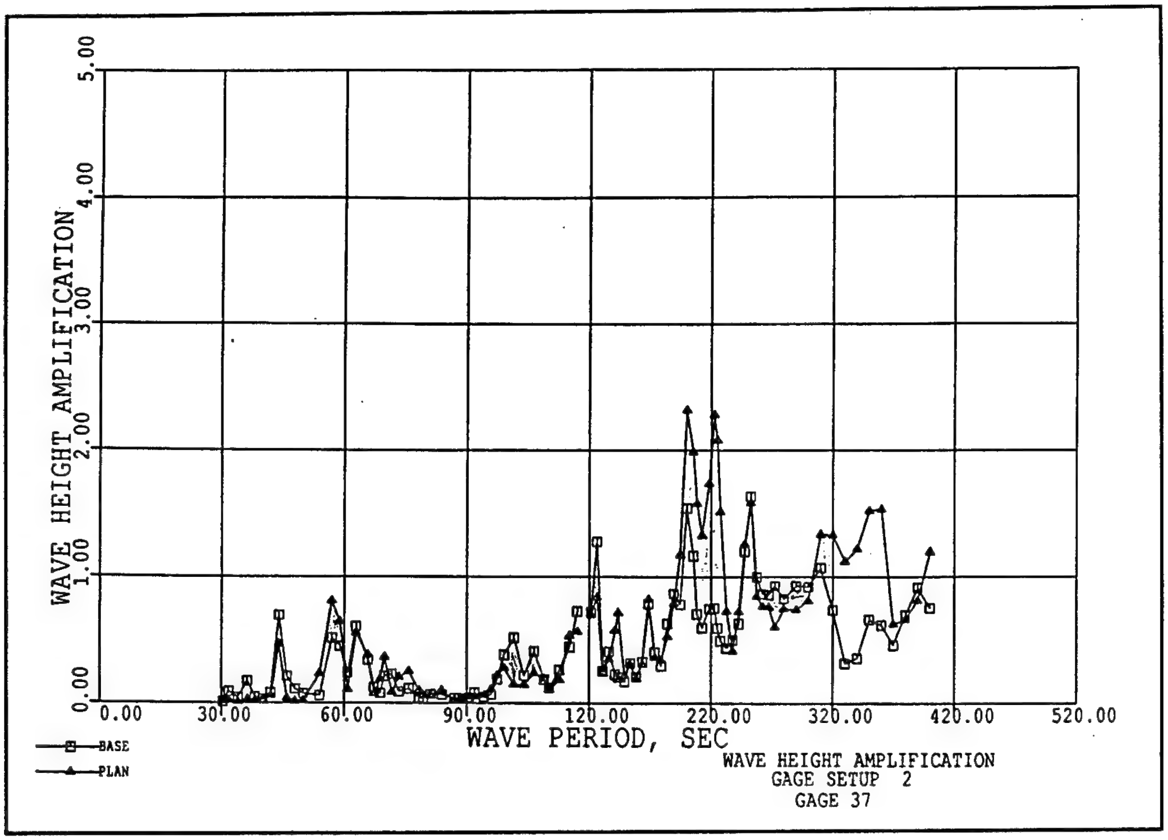
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 2
GAGE 36


WAVE HEIGHT AMPLIFICATION
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60.00
90.00
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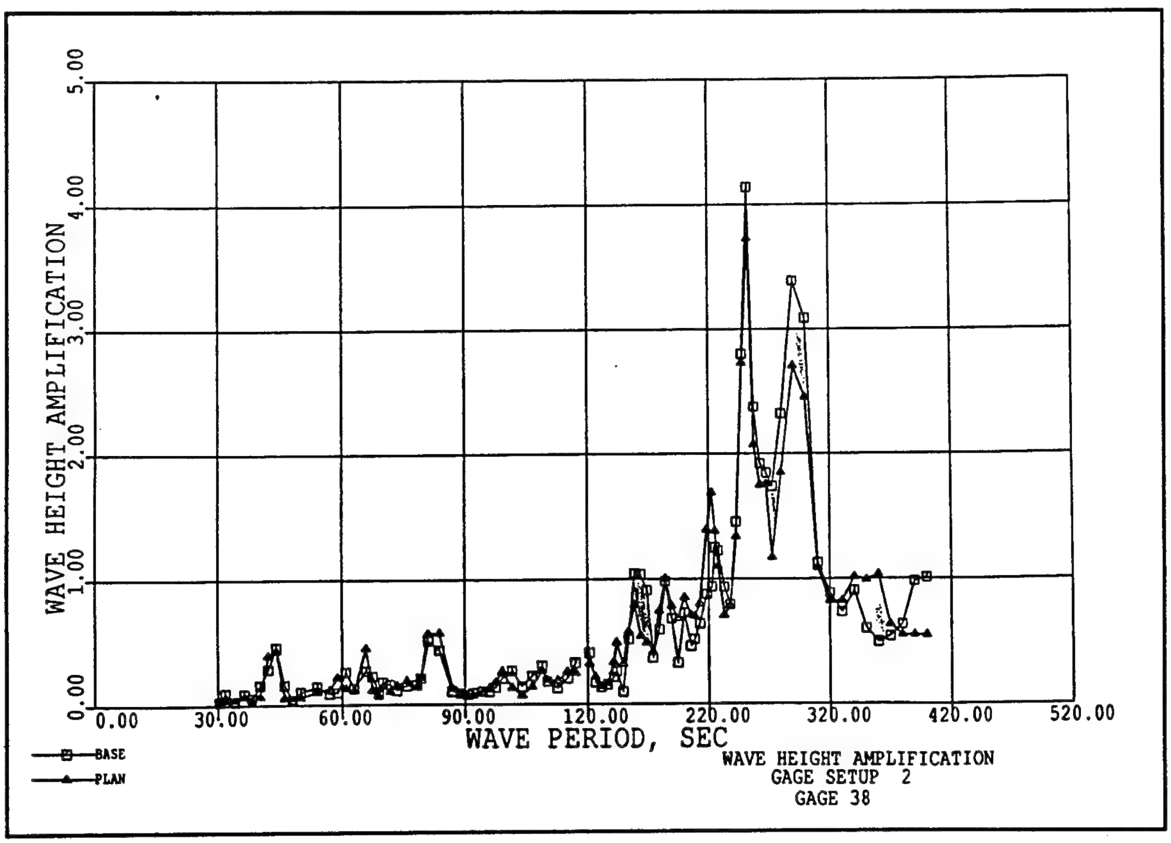
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 2
GAGE 37


WAVE HEIGHT AMPLIFICATION
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60.00
90.00
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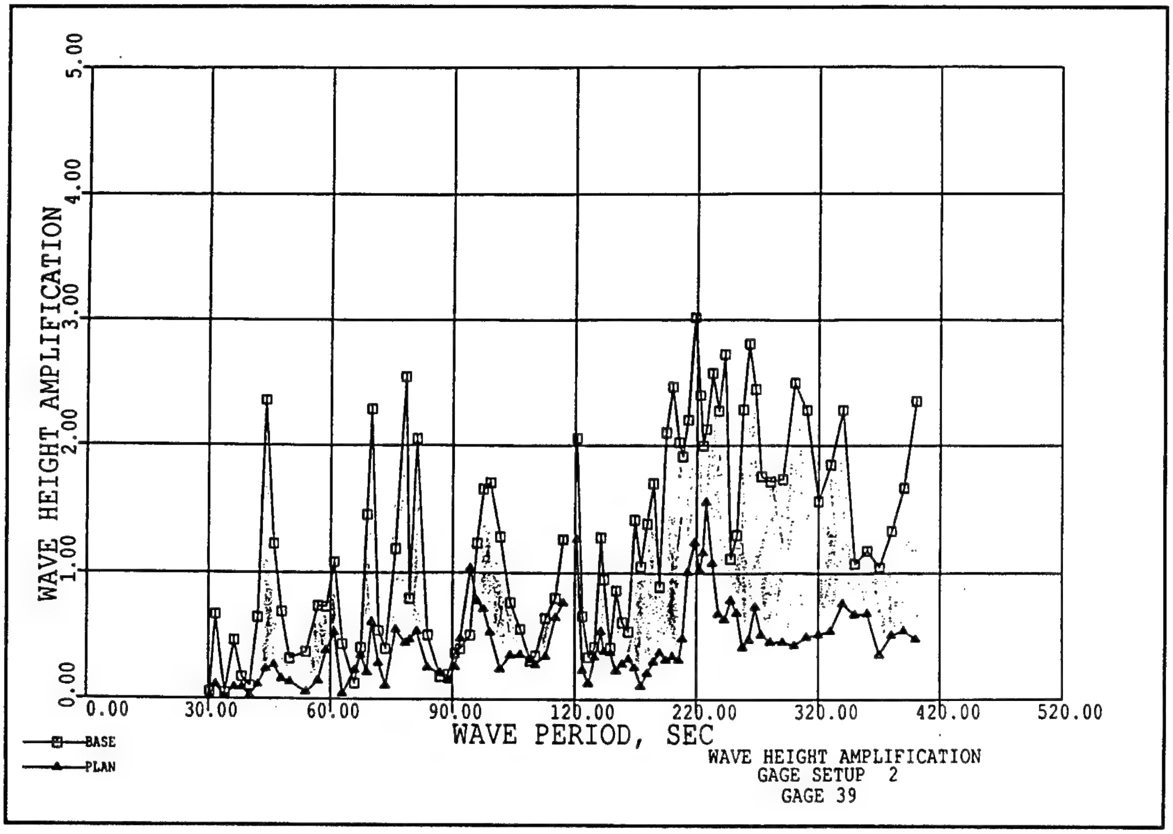
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 2
GAGE 38


WAVE HEIGHT AMPLIFICATION
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3.00
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5.00
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30.00
60.00
90.00
120.00
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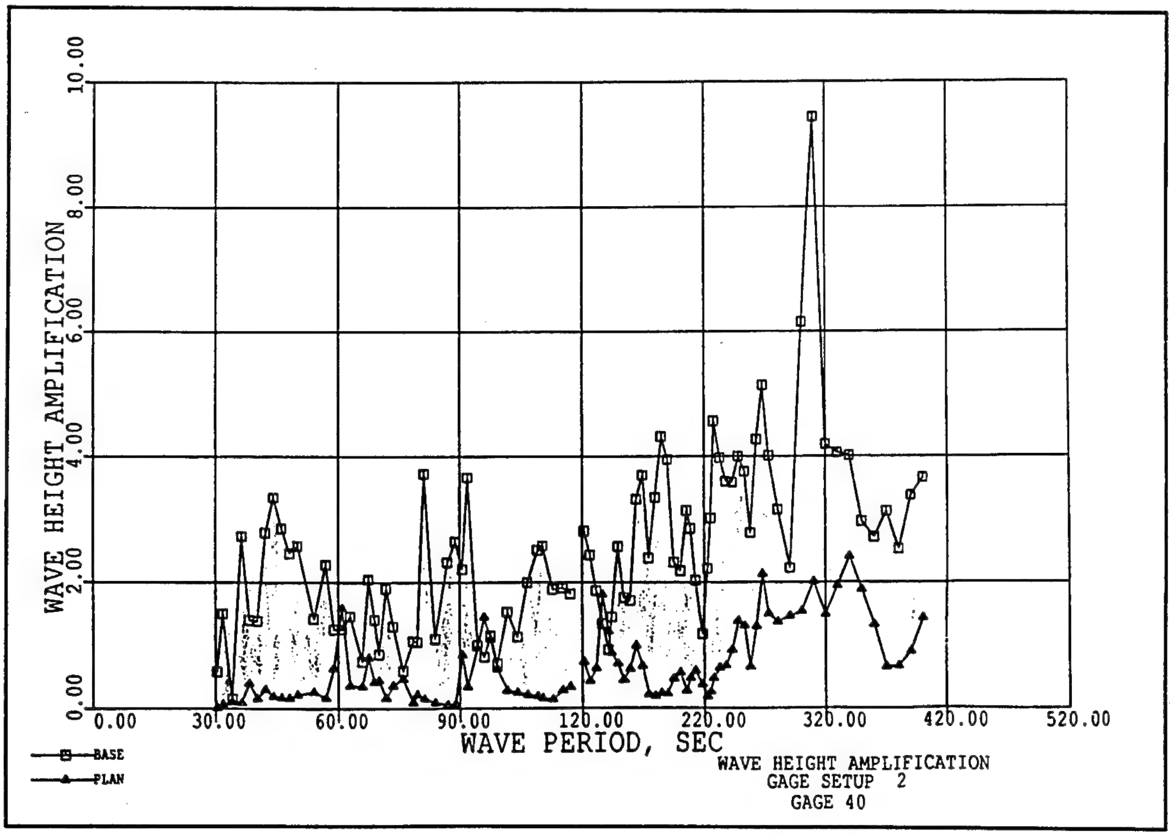
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 2
GAGE 39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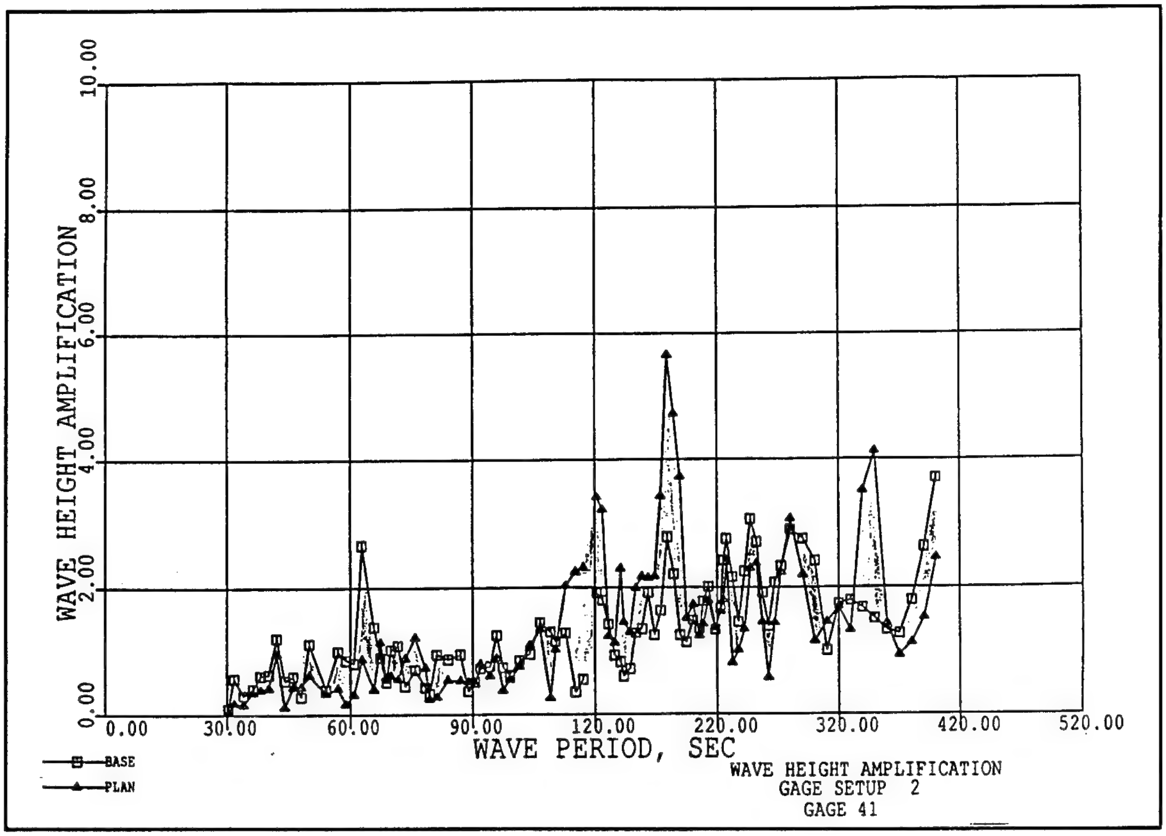
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 2
GAGE 40



WAVE HEIGHT AMPLIFICATION
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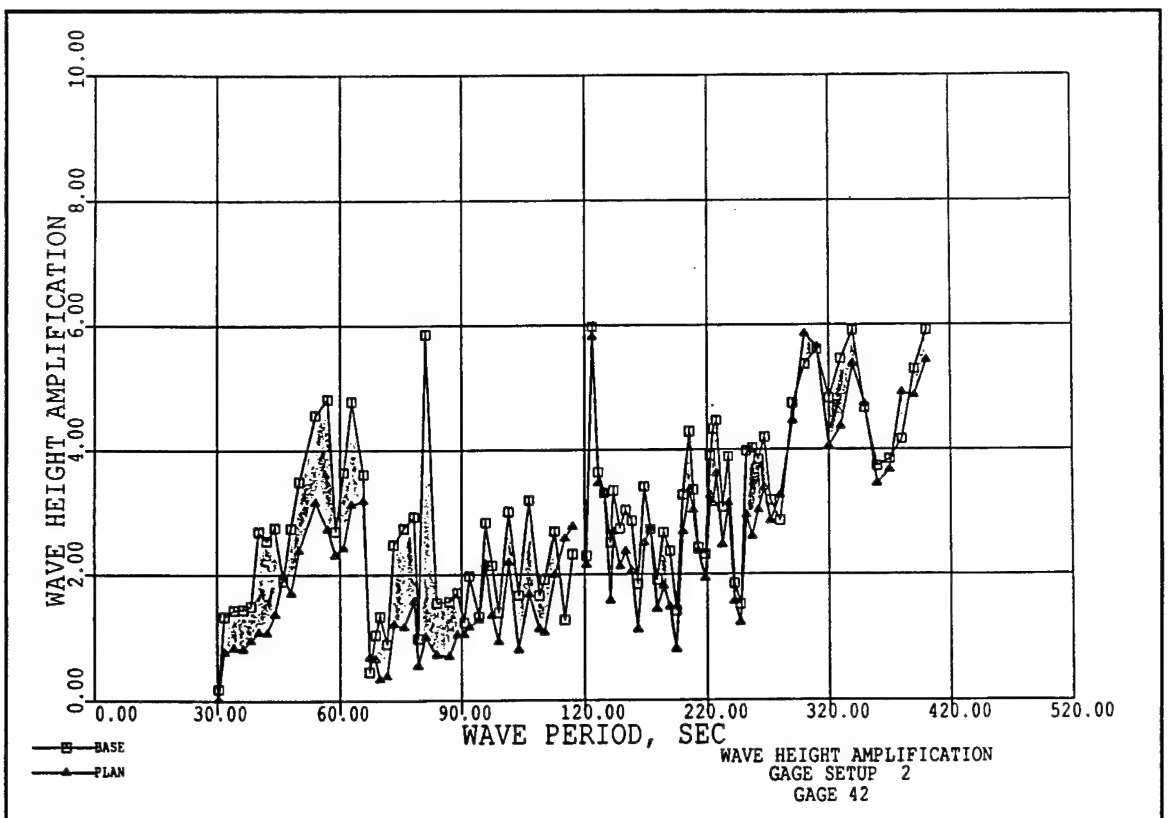
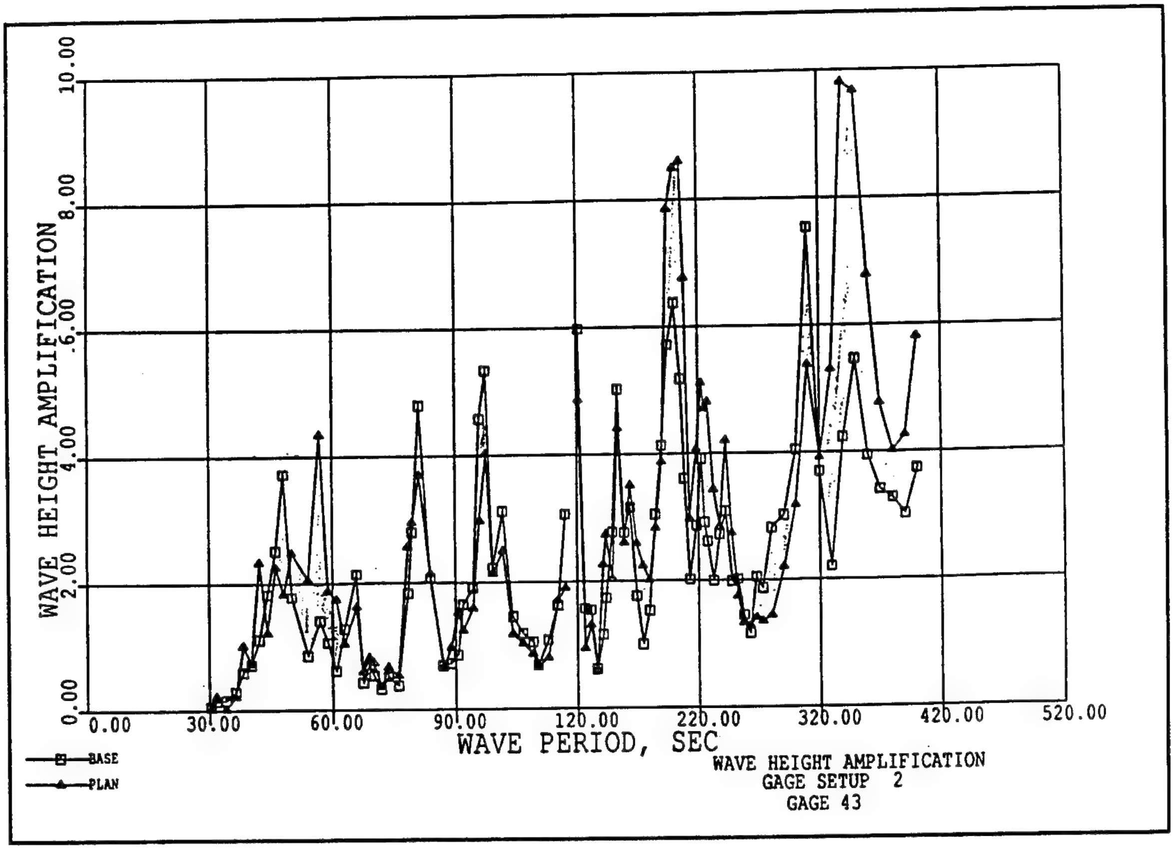
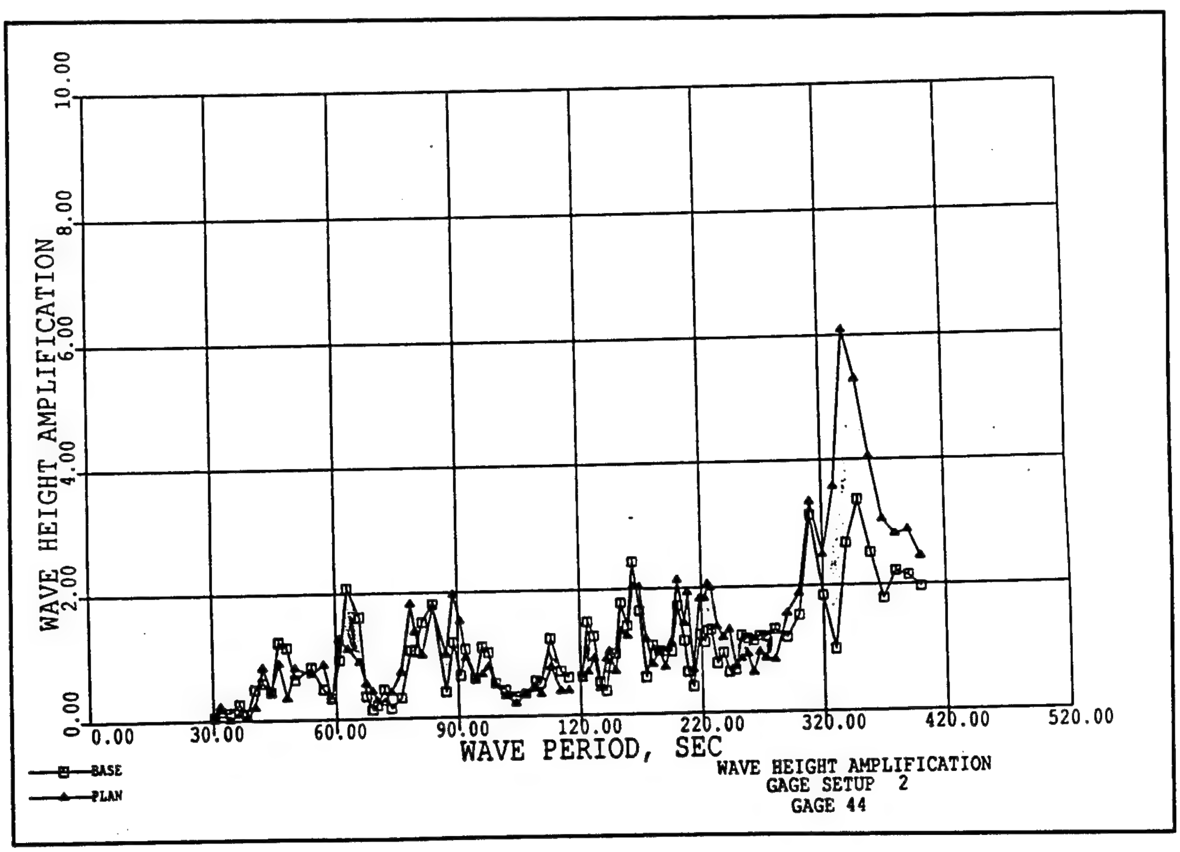
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 2
GAGE 41

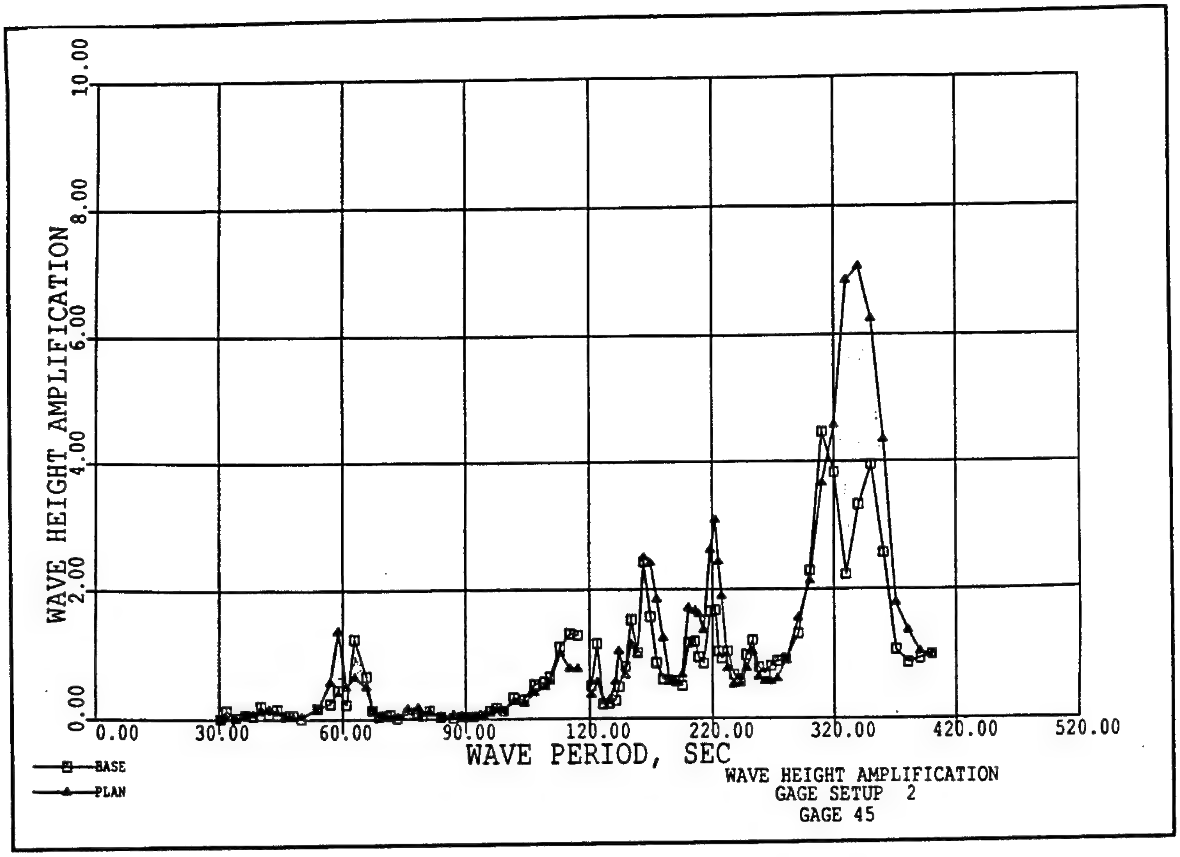
WAVE HEIGHT AMPLIFICATION
0.00
2.00
4.00
6.00
8.00
10.00
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 2
GAGE 42



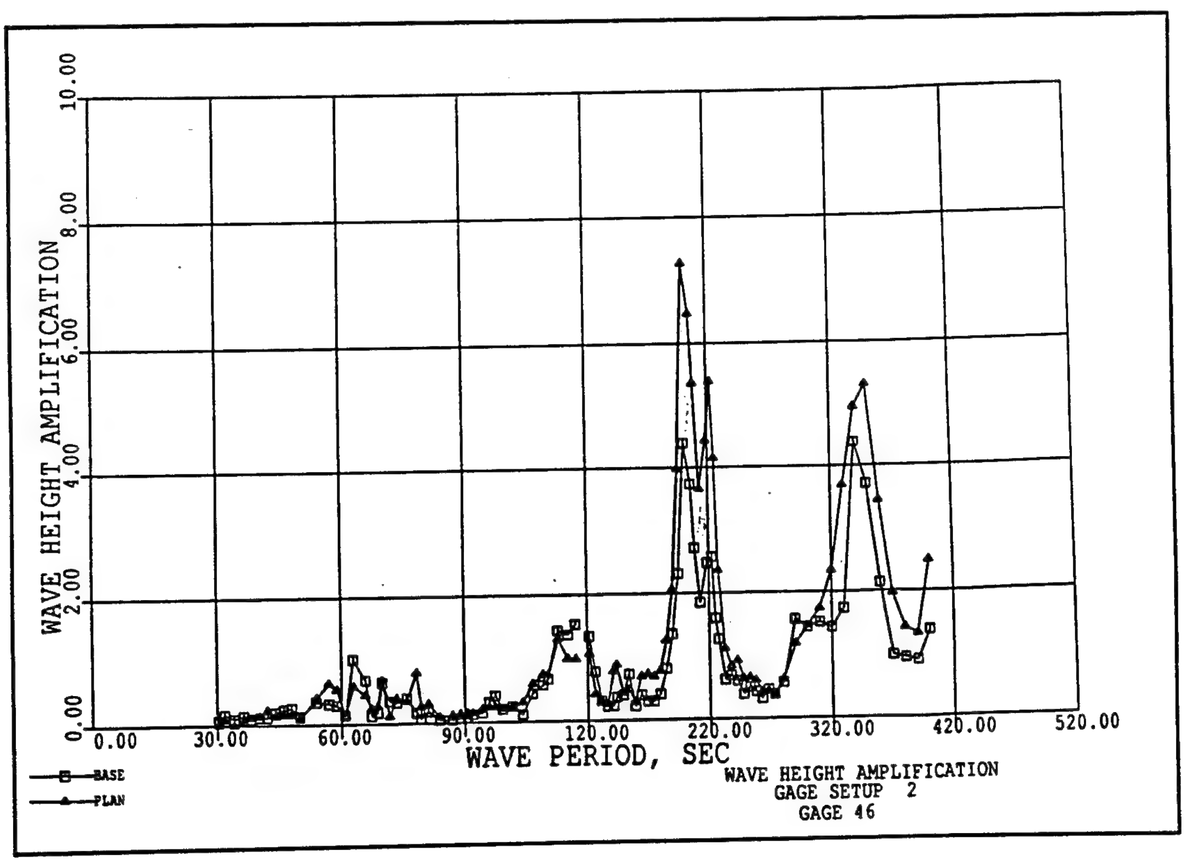
WAVE HEIGHT AMPLIFICATION
0.00
2.00
4.00
6.00
8.00
10.00
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 2
GAGE 43

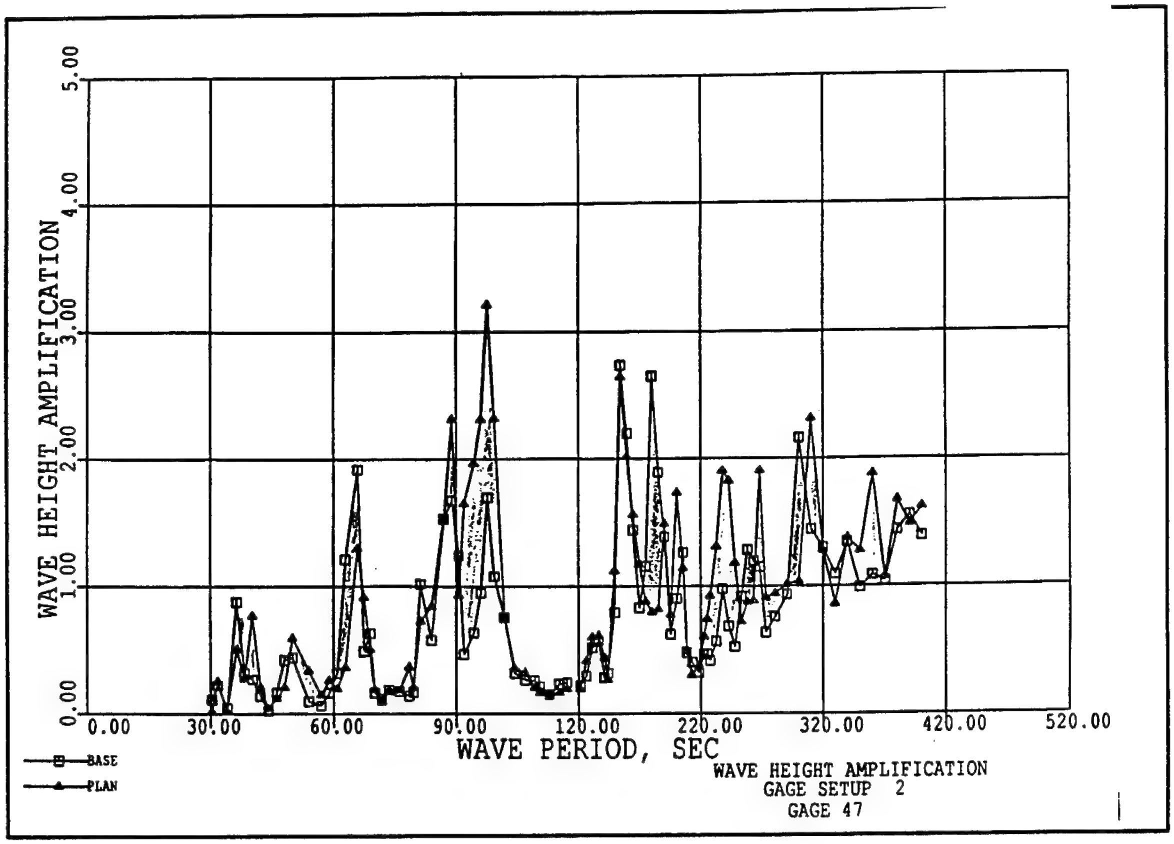
WAVE HEIGHT AMPLIFICATION
0.00
2.00
4.00
6.00
8.00
10.00
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 2
GAGE 44

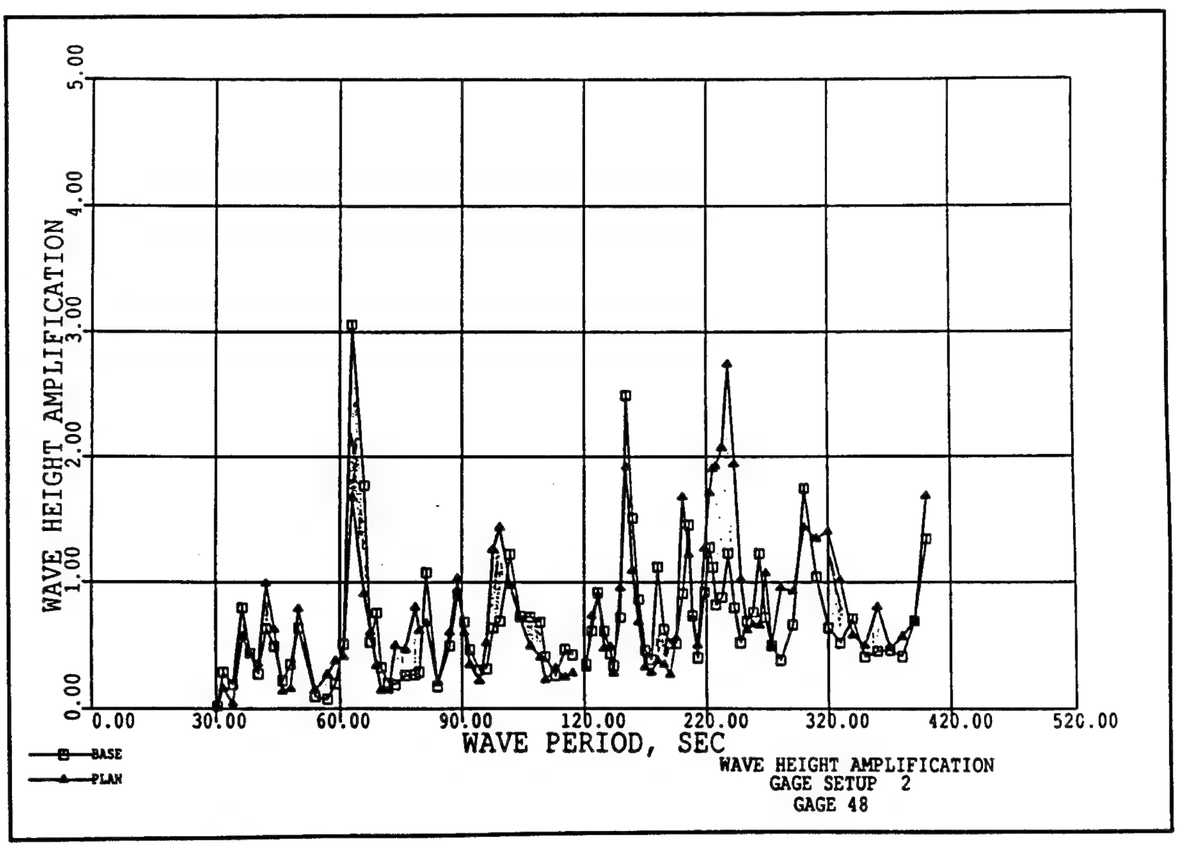


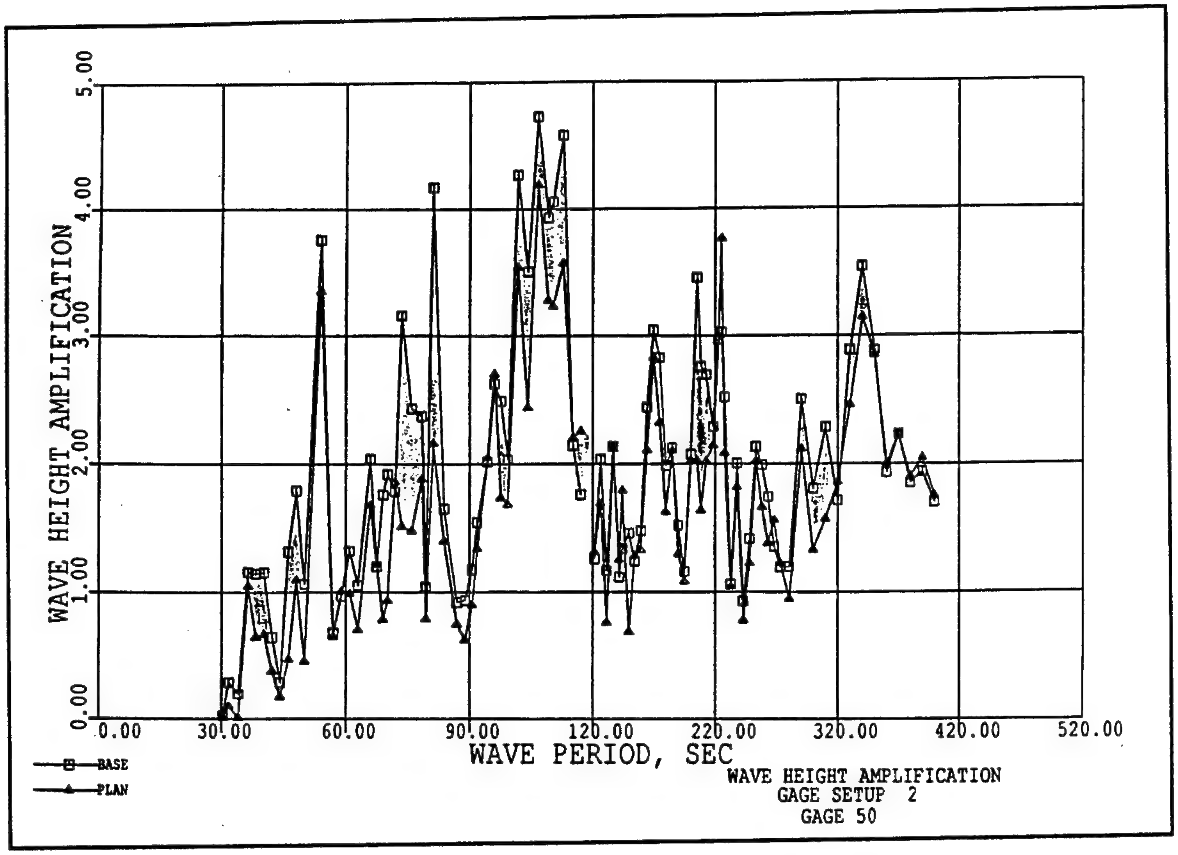
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SEC
0.00
2.00
4.00
6.00
8.00
10.00
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 2
GAGE 45

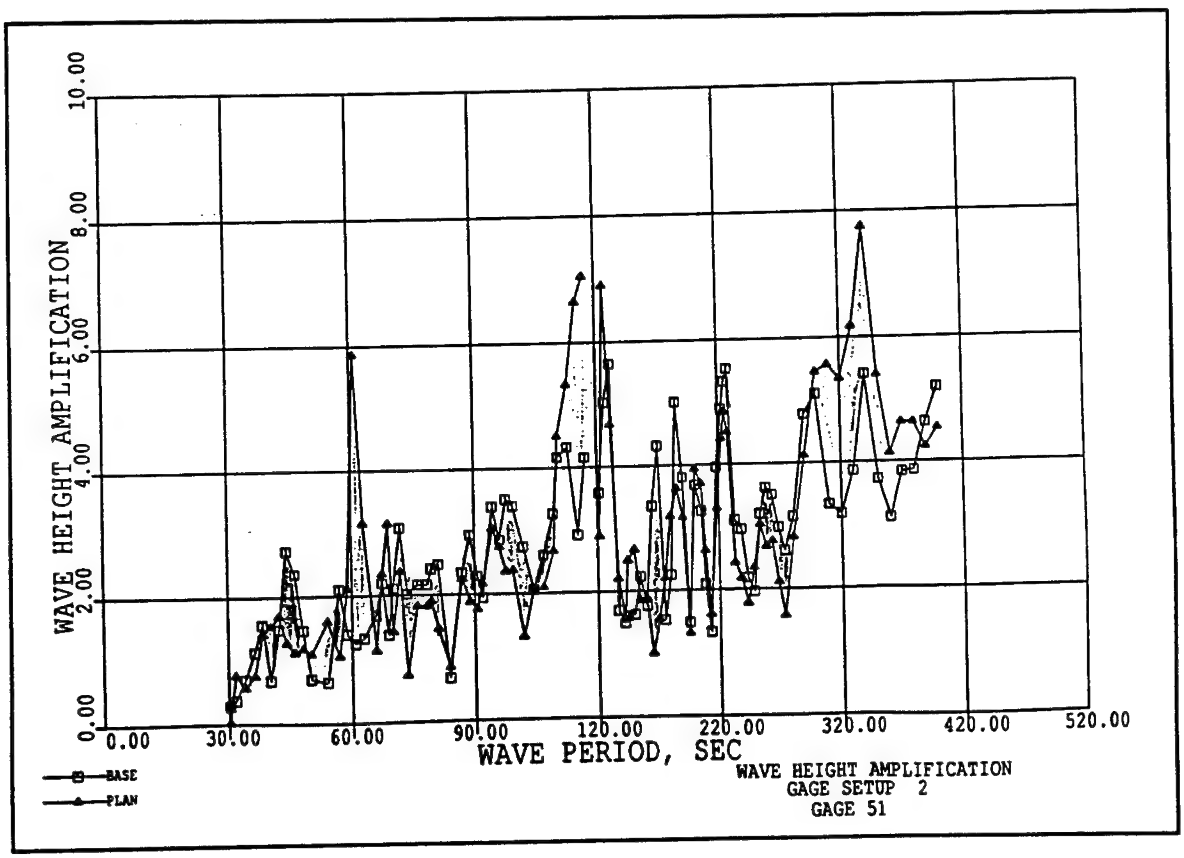



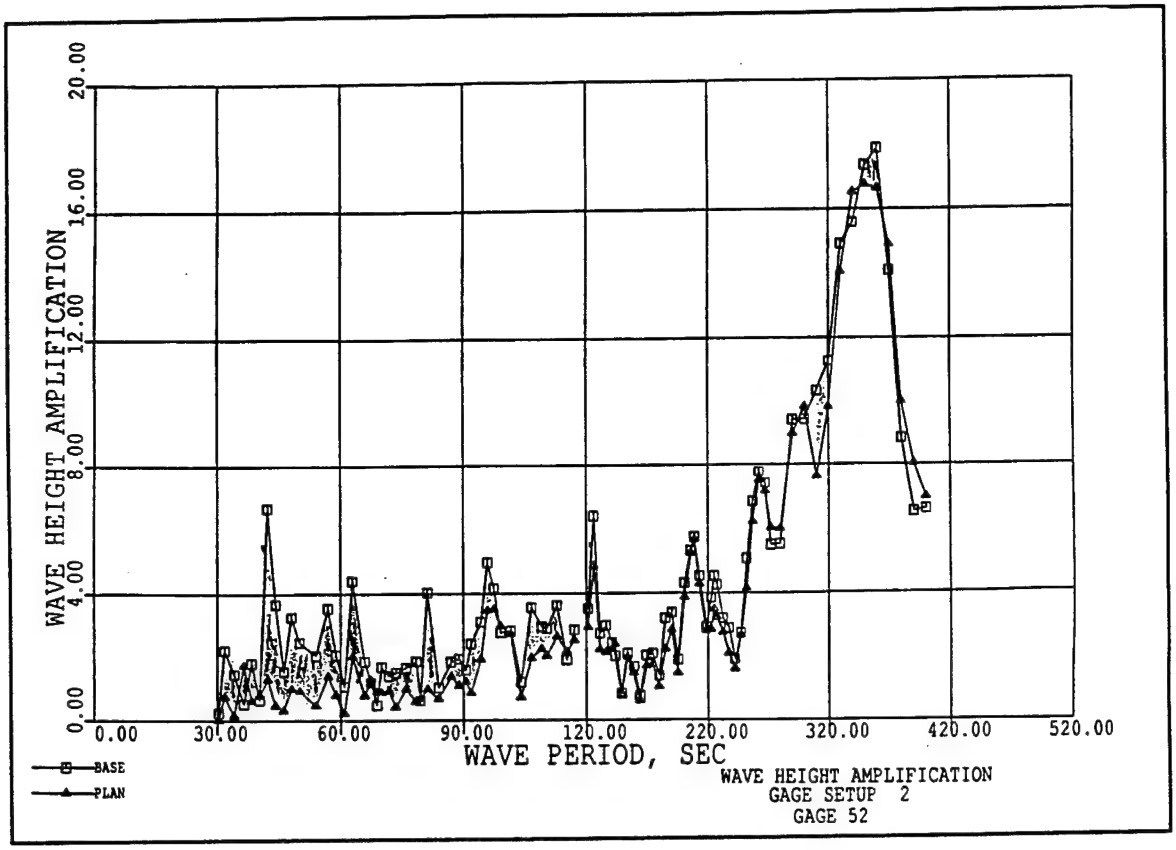
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SEC
0.00
2.00
4.00
6.00
8.00
10.00
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 2
GAGE 46

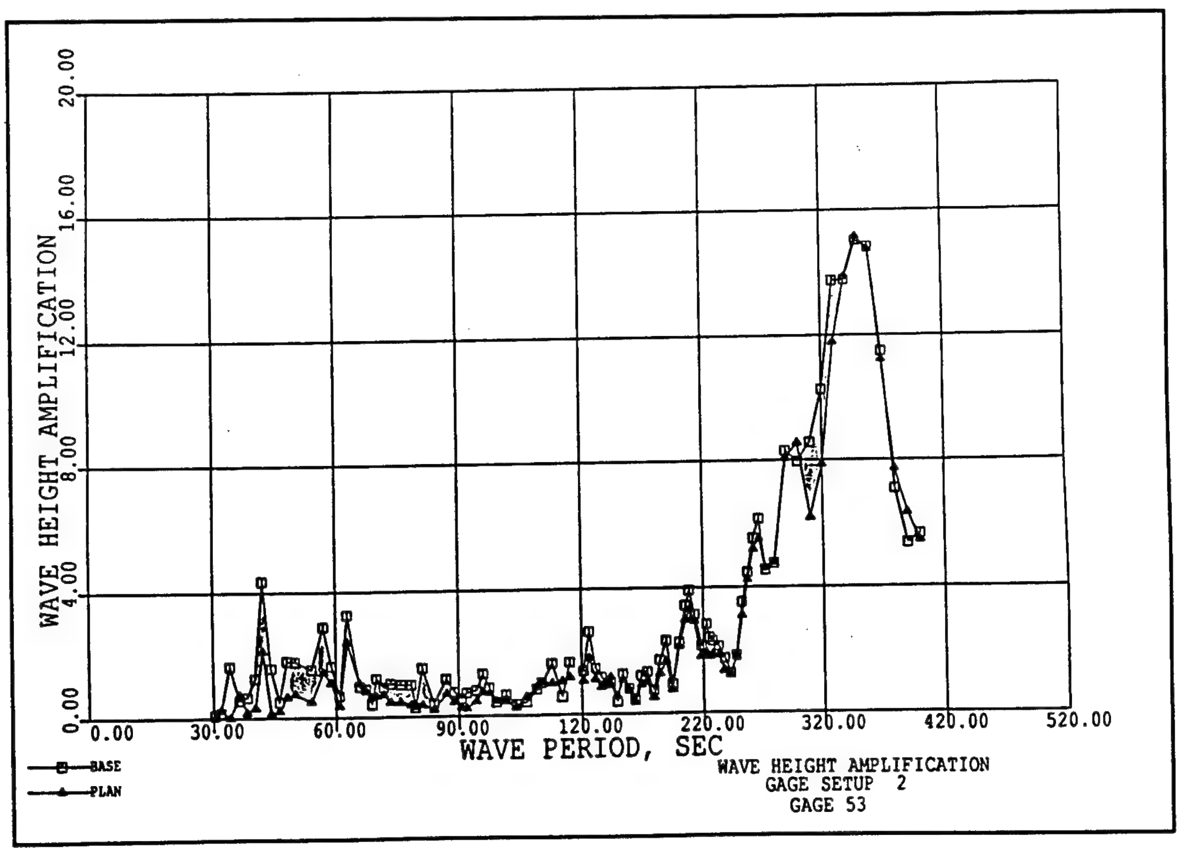

5.00
4.00
3.00
2.00
1.00
0.00
WAVE HEIGHT AMPLIFICATION
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 2
GAGE 47

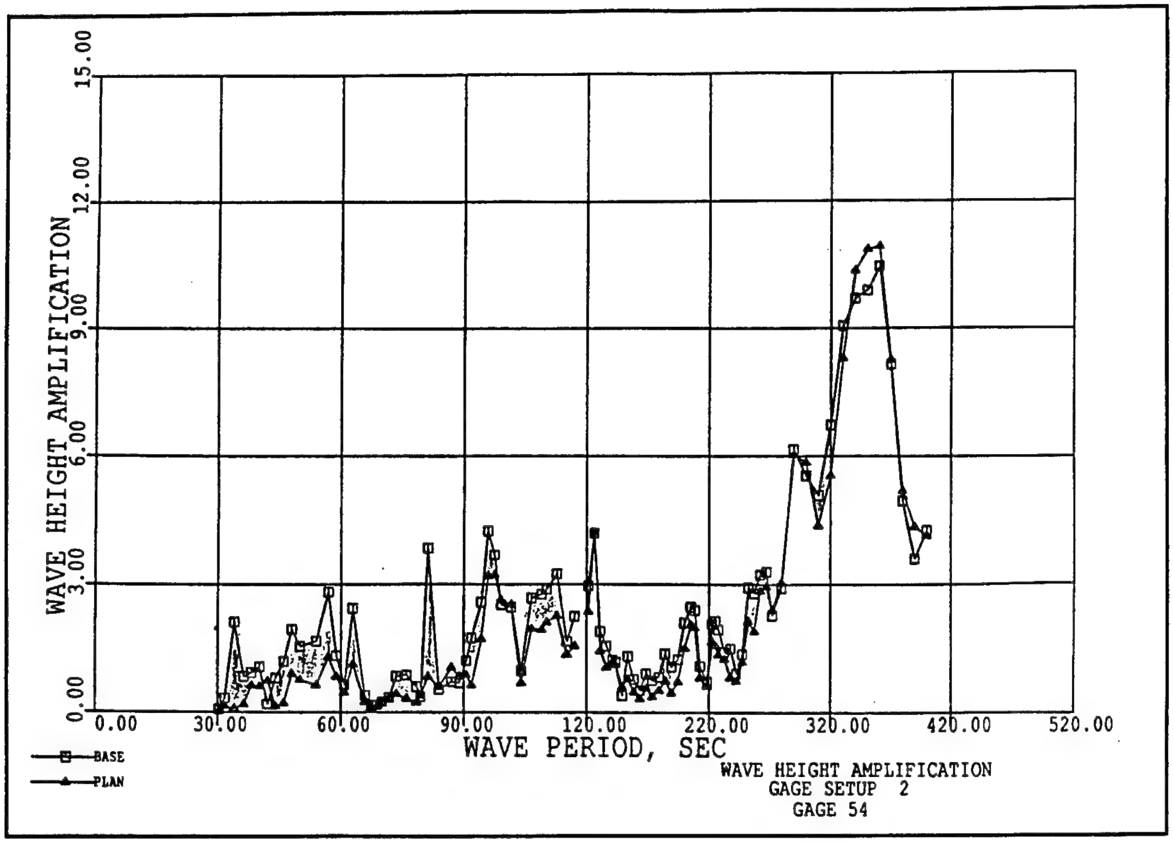

5.00
4.00
3.00
2.00
1.00
0.00
WAVE HEIGHT AMPLIFICATION
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 2
GAGE 48


WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SEC
0.00
1.00
2.00
3.00
4.00
5.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 2
GAGE 50

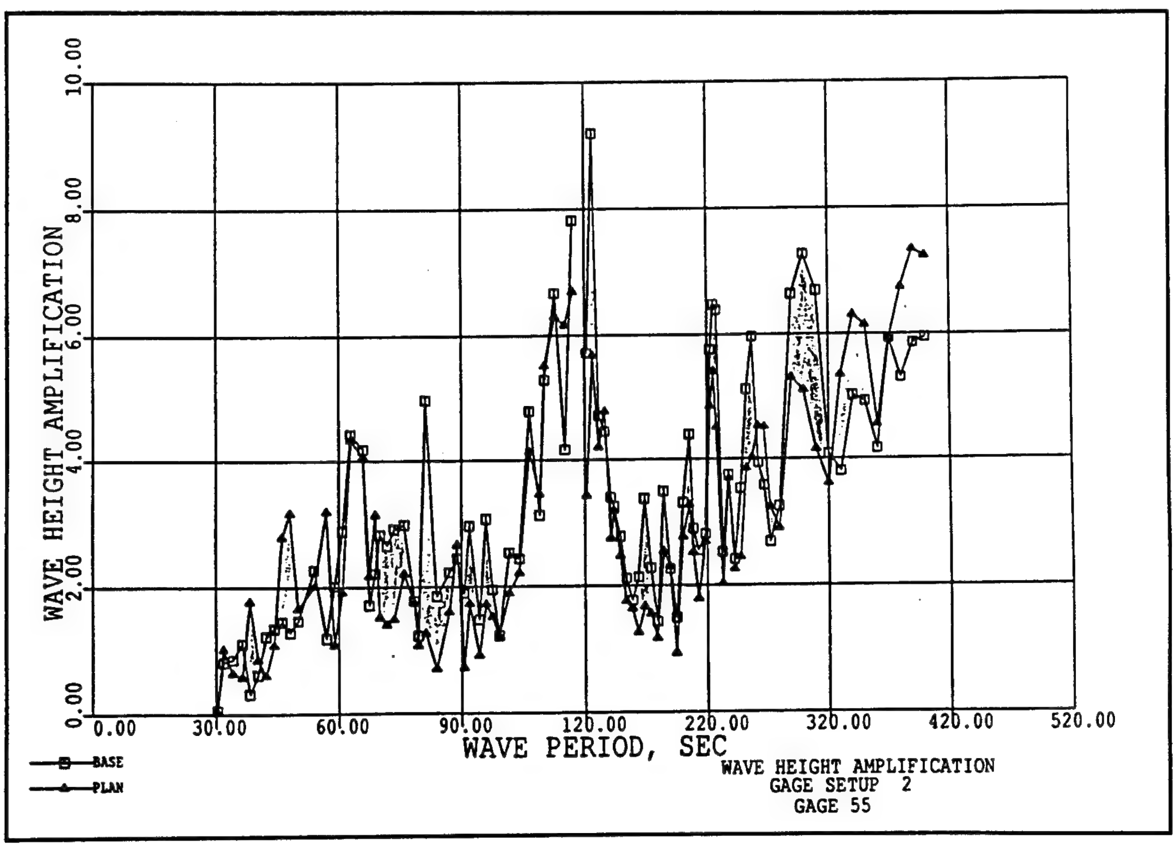

WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SEC
0.00
2.00
4.00
6.00
8.00
10.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 2
GAGE 51


WAVE HEIGHT AMPLIFICATION
0.00
4.00
8.00
12.00
16.00
20.00
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 2
GAGE 52

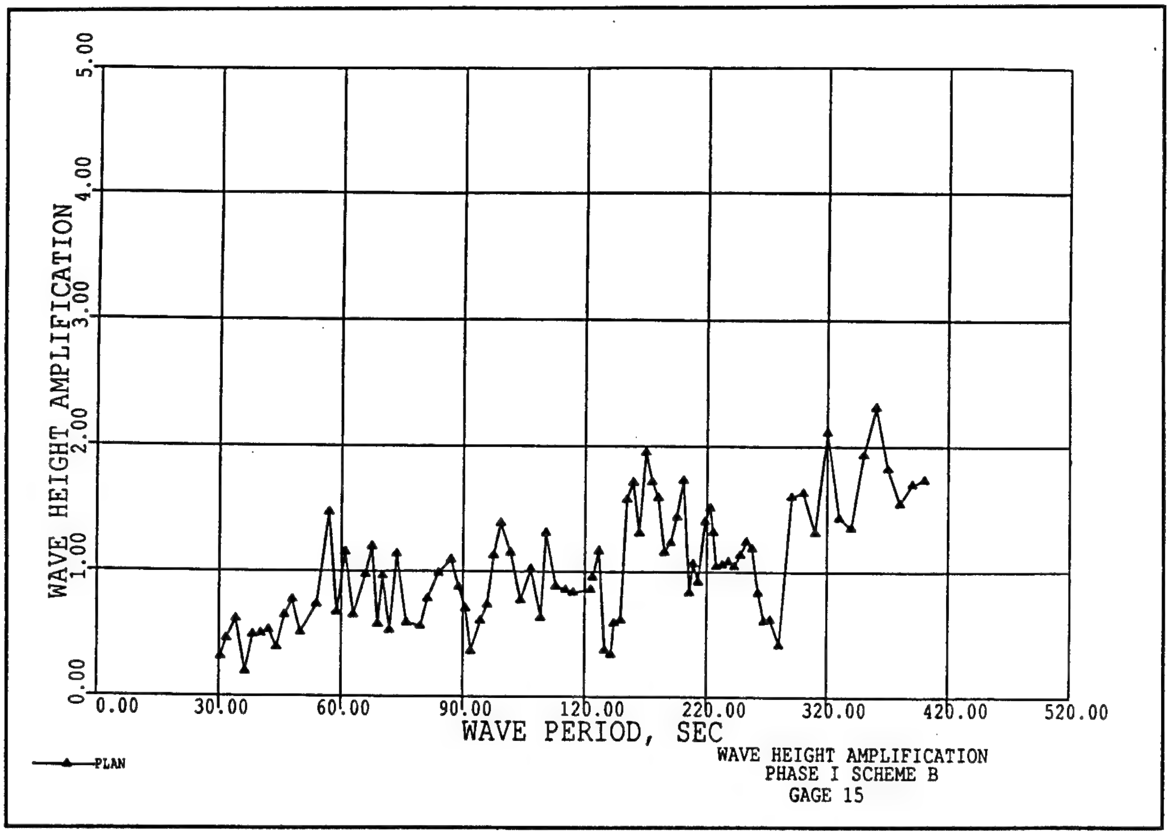

WAVE HEIGHT AMPLIFICATION
0.00
4.00
8.00
12.00
16.00
20.00
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 2
GAGE 53



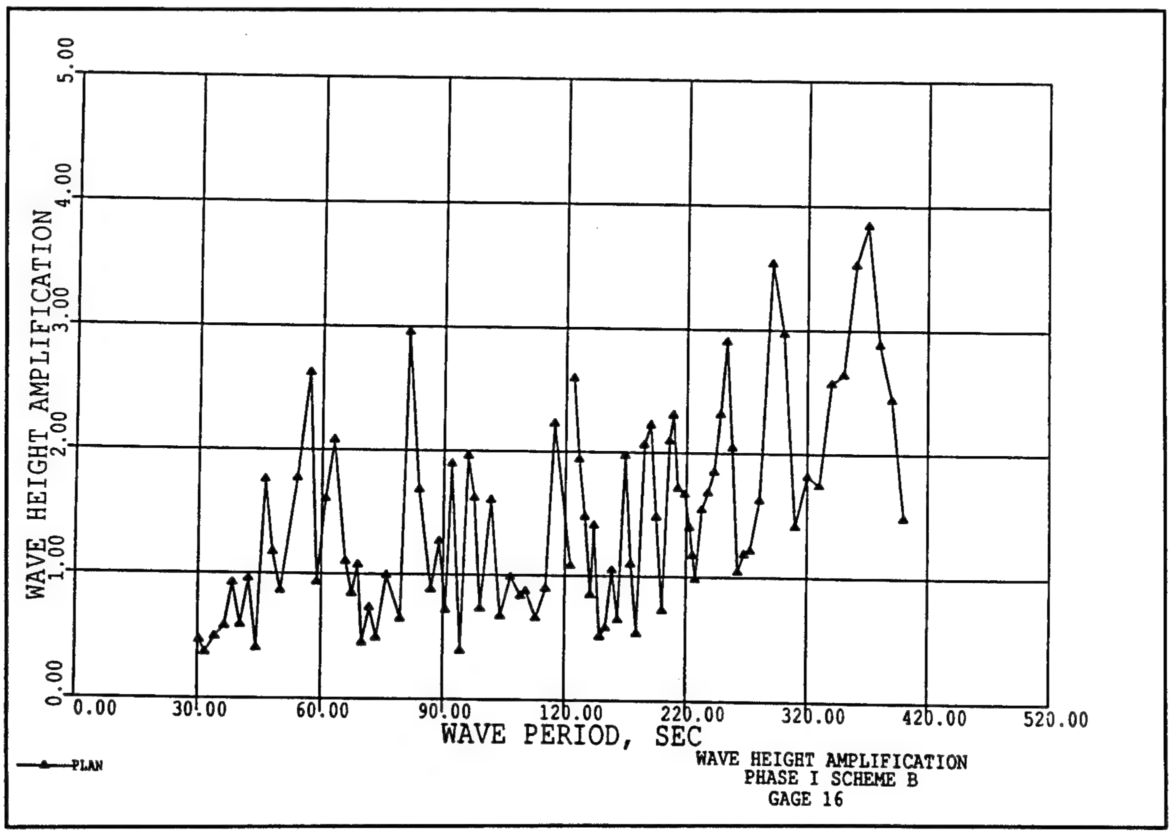
WAVE HEIGHT AMPLIFICATION
0.00
3.00
6.00
9.00
12.00
15.00
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 2
GAGE 54

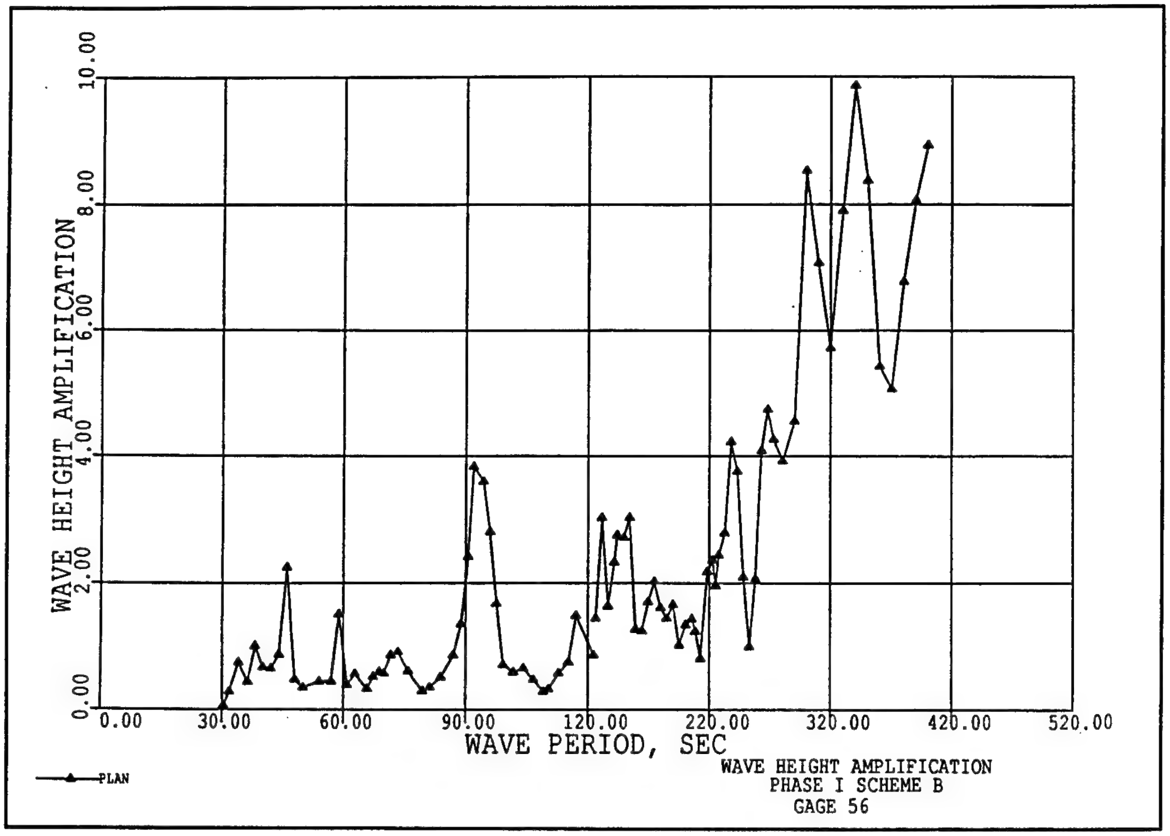
WAVE HEIGHT AMPLIFICATION
0.00
2.00
4.00
6.00
8.00
10.00
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
BASE
PLAN
WAVE HEIGHT AMPLIFICATION
GAGE SETUP 2
GAGE 55

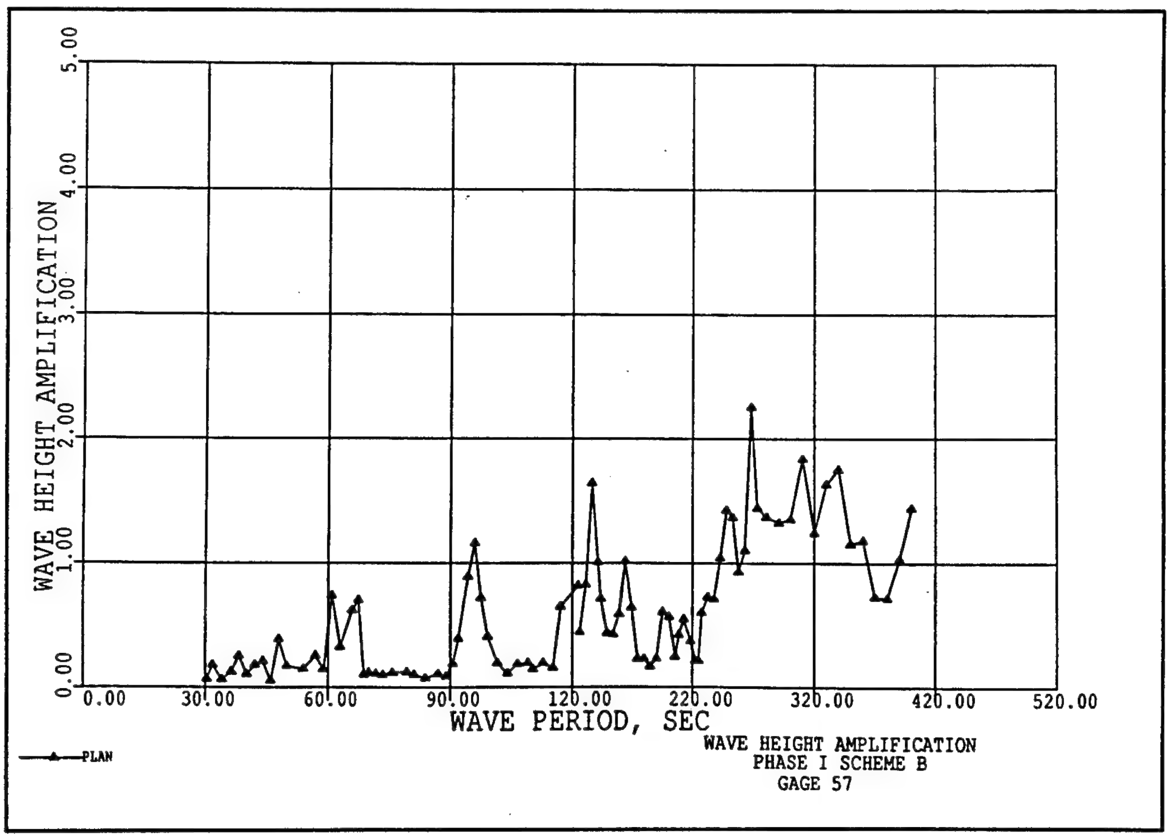


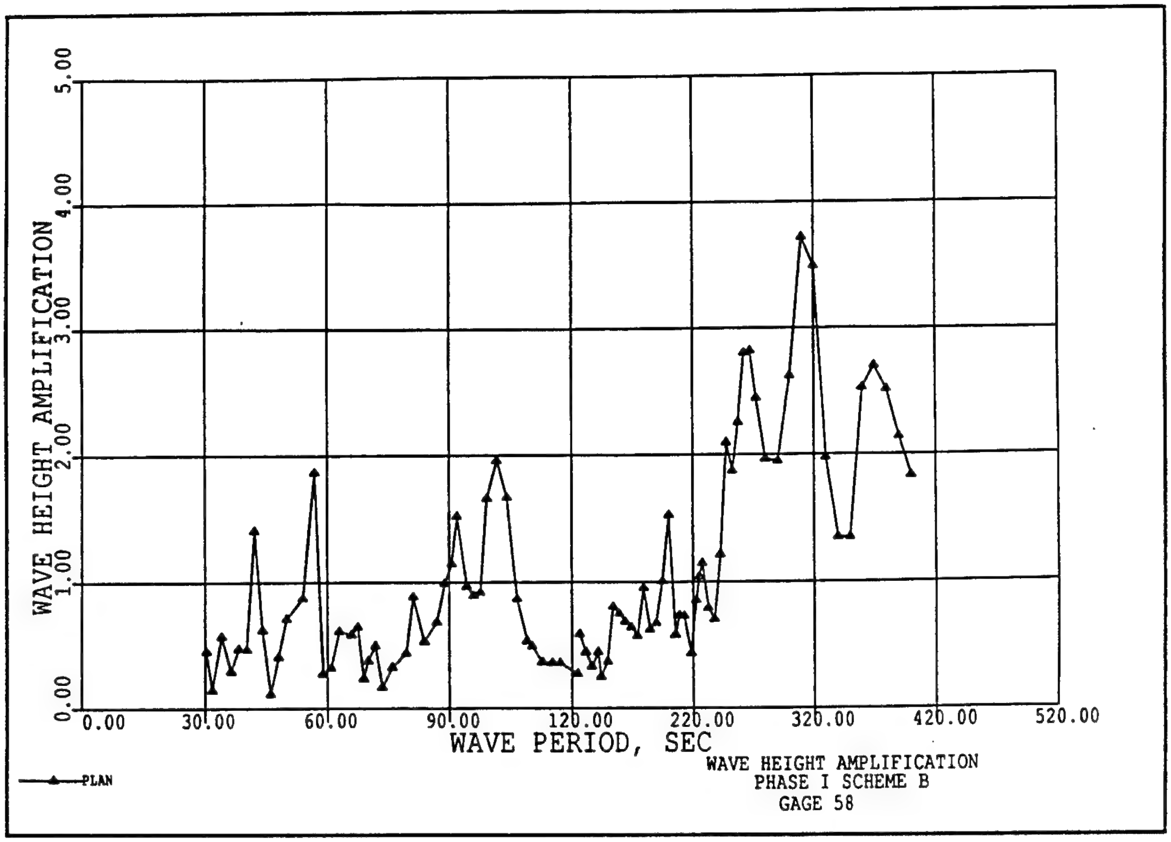
5.00
4.00
3.00
2.00
1.00
0.00
WAVE HEIGHT AMPLIFICATION
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
PLAN
WAVE HEIGHT AMPLIFICATION
PHASE I SCHEME B
GAGE 15

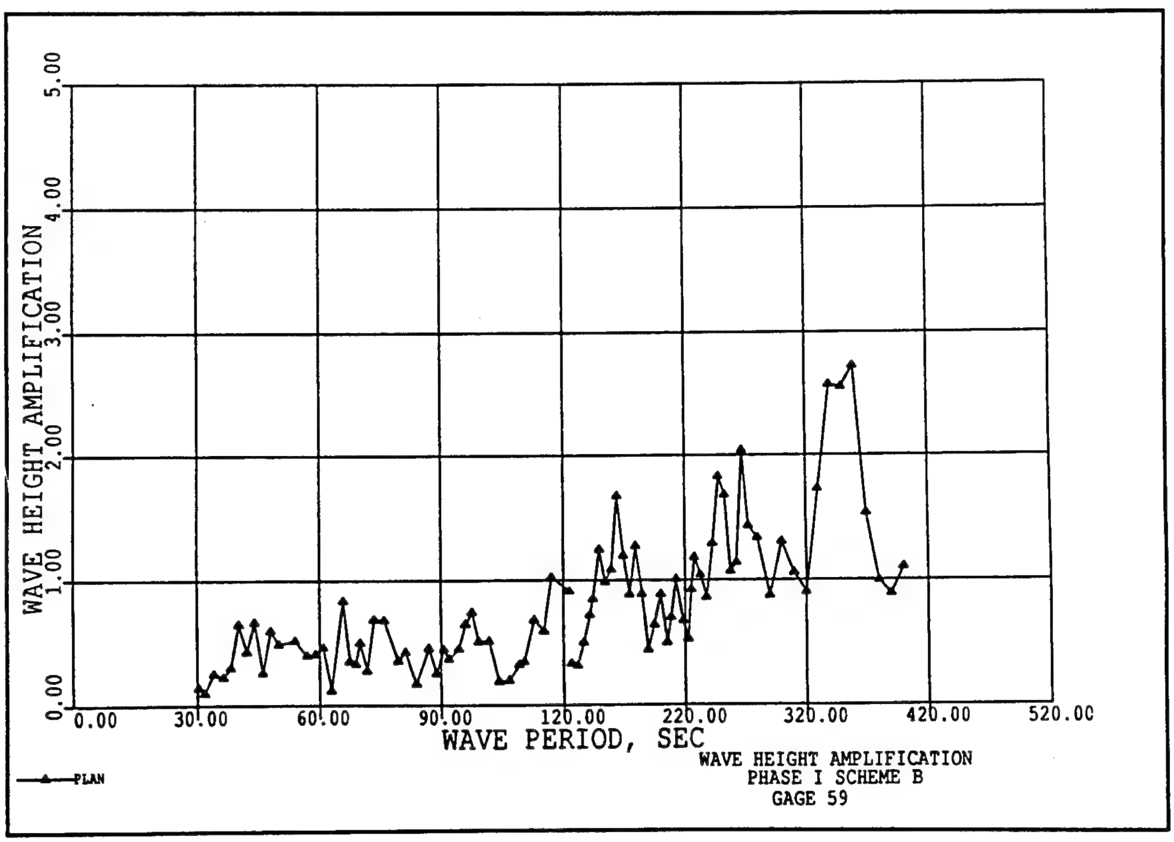



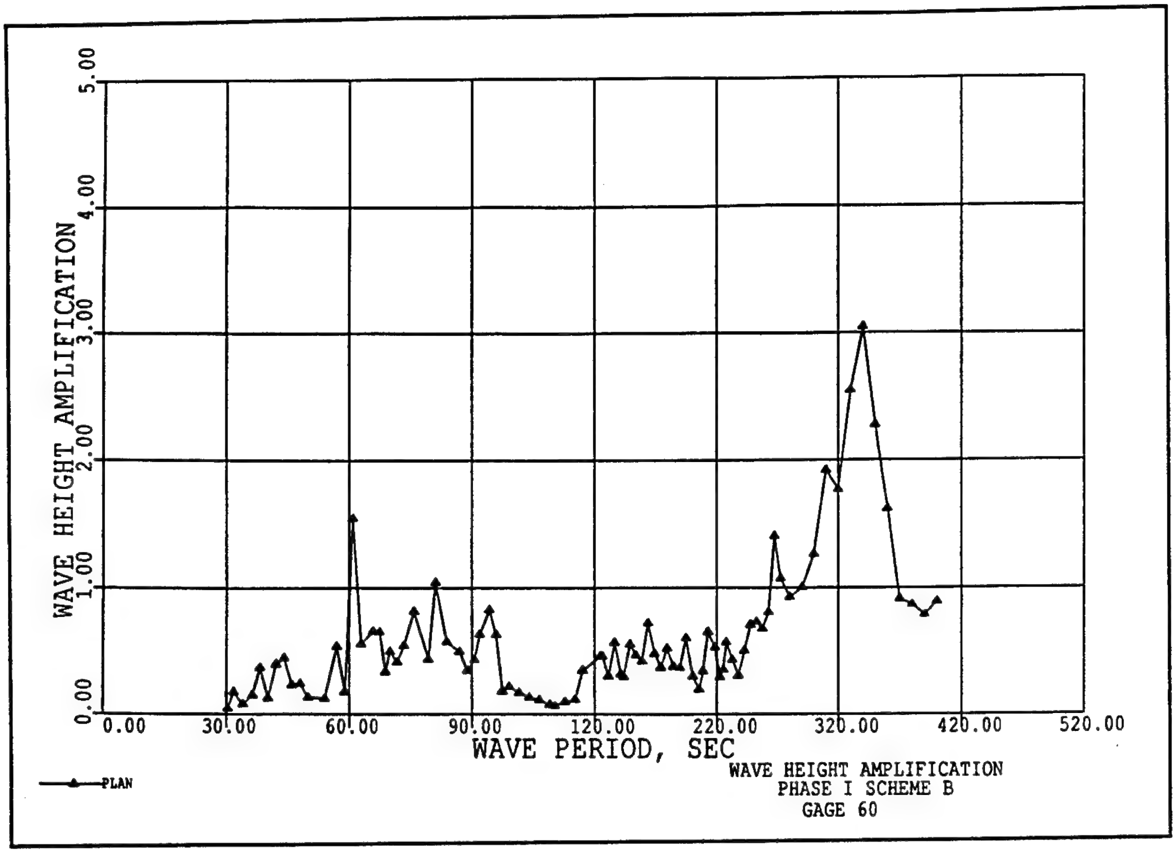
5.00
4.00
3.00
2.00
1.00
0.00
WAVE HEIGHT AMPLIFICATION
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
PLAN
WAVE HEIGHT AMPLIFICATION
PHASE I SCHEME B
GAGE 16

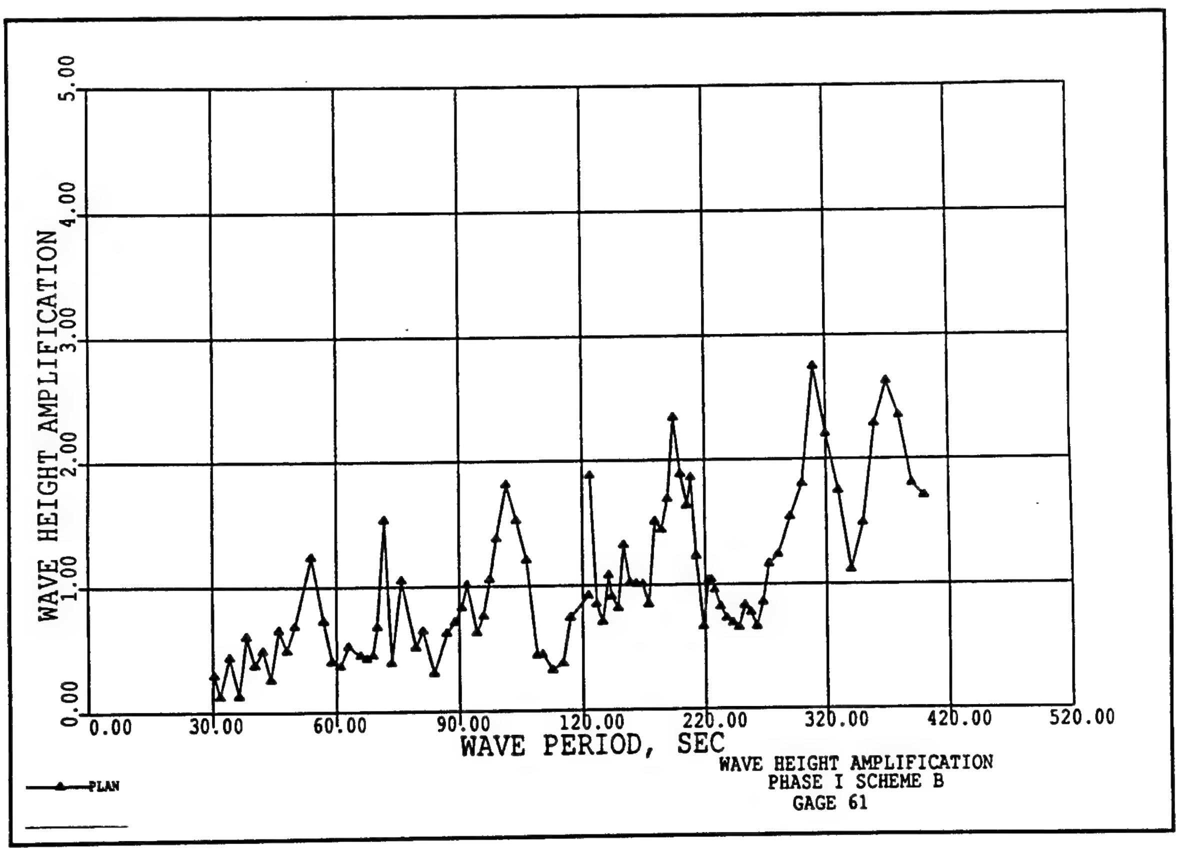

10.00
8.00
6.00
4.00
2.00
0.00
WAVE HEIGHT AMPLIFICATION
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
PLAN
WAVE HEIGHT AMPLIFICATION
PHASE I SCHEME B
GAGE 56

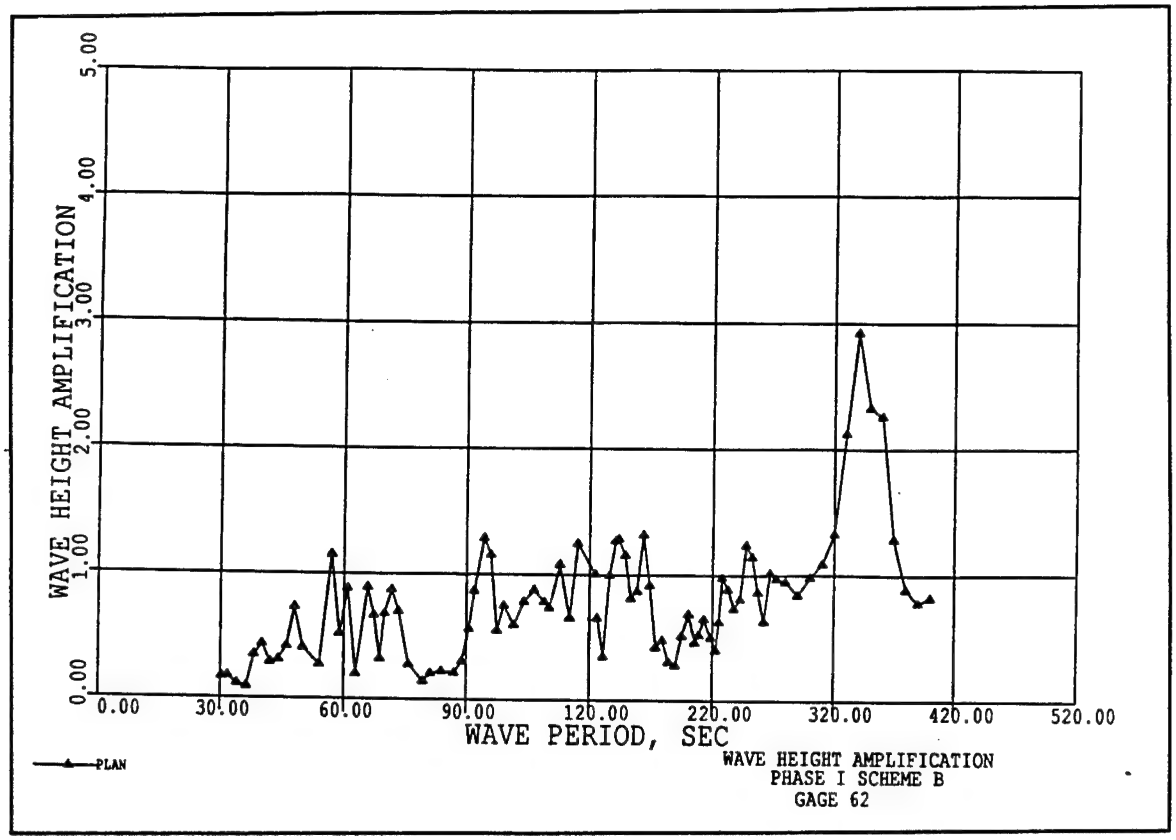

5.00
4.00
3.00
2.00
1.00
0.00
WAVE HEIGHT AMPLIFICATION
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
PLAN
WAVE HEIGHT AMPLIFICATION
PHASE I SCHEME B
GAGE 57

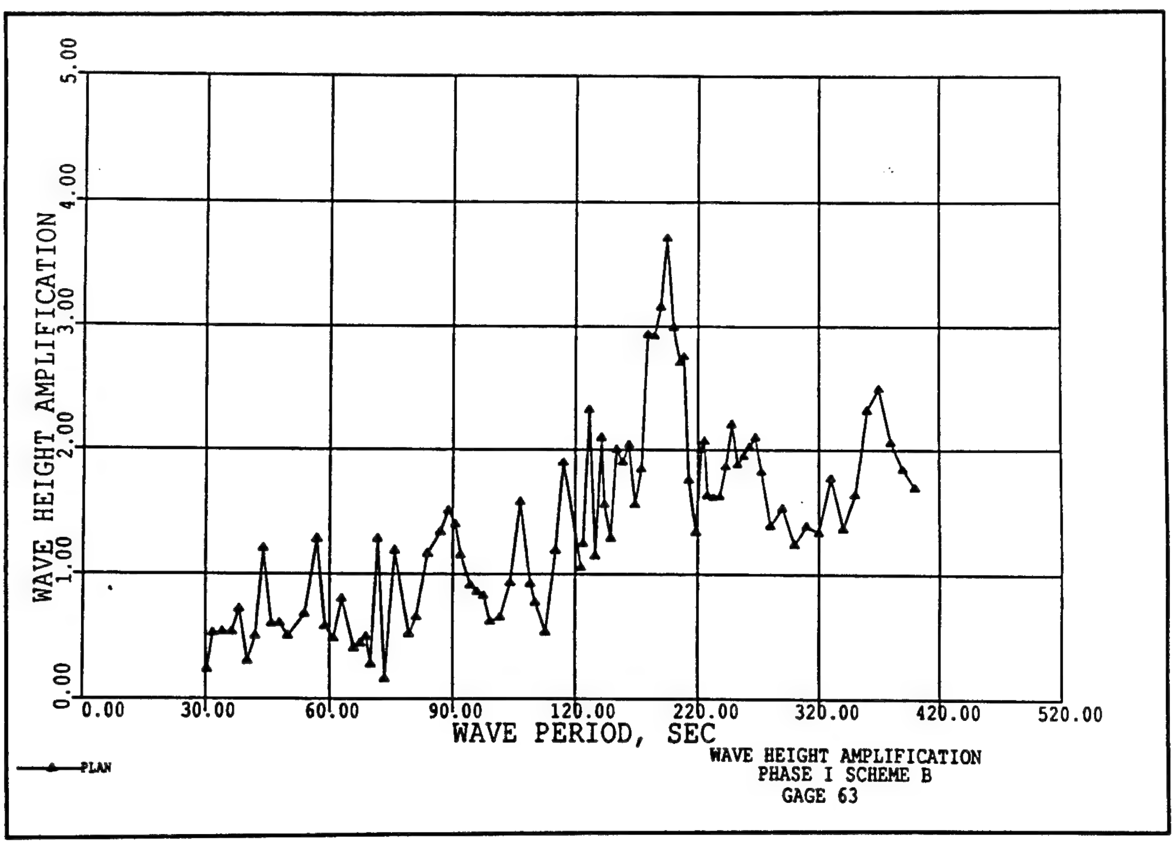

WAVE HEIGHT AMPLIFICATION
0.00
1.00
2.00
3.00
4.00
5.00
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
PLAN
WAVE HEIGHT AMPLIFICATION
PHASE I SCHEME B
GAGE 58

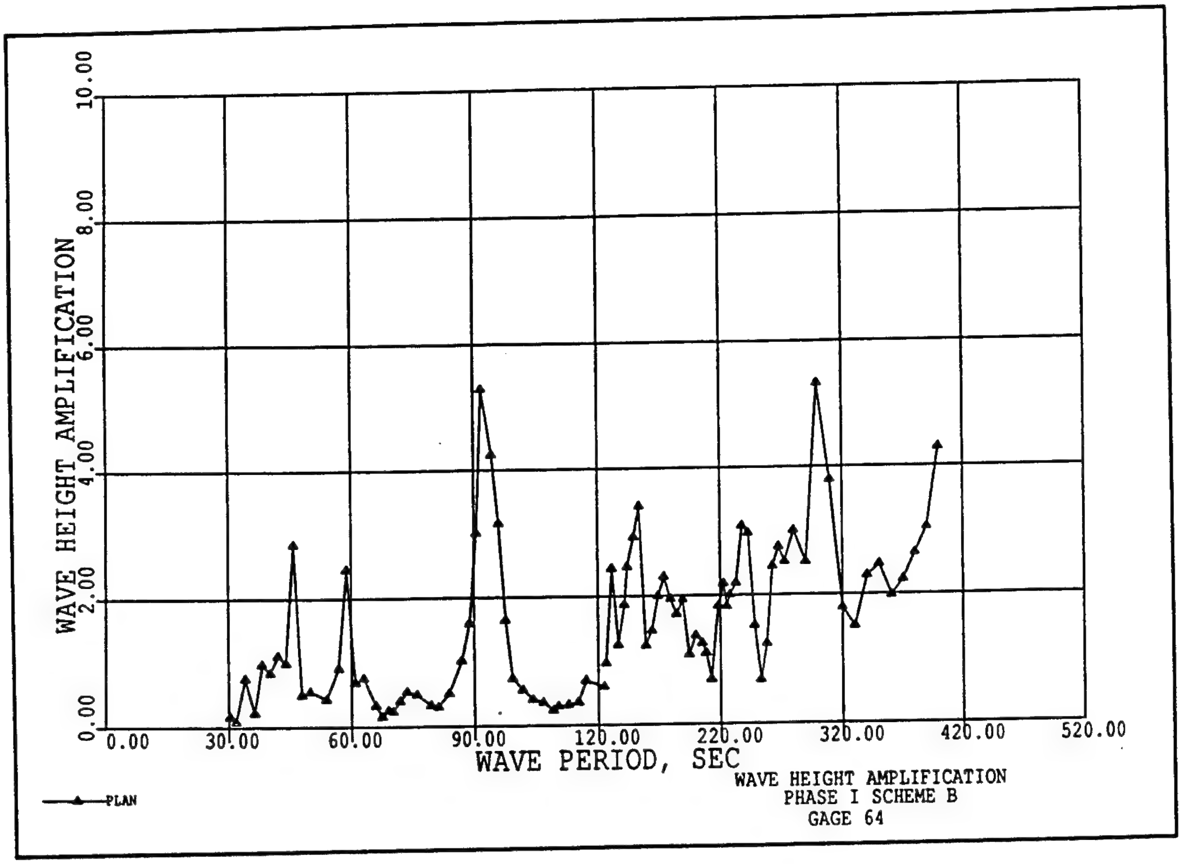

WAVE HEIGHT AMPLIFICATION
0.00
1.00
2.00
3.00
4.00
5.00
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
PLAN
WAVE HEIGHT AMPLIFICATION
PHASE I SCHEME B
GAGE 59

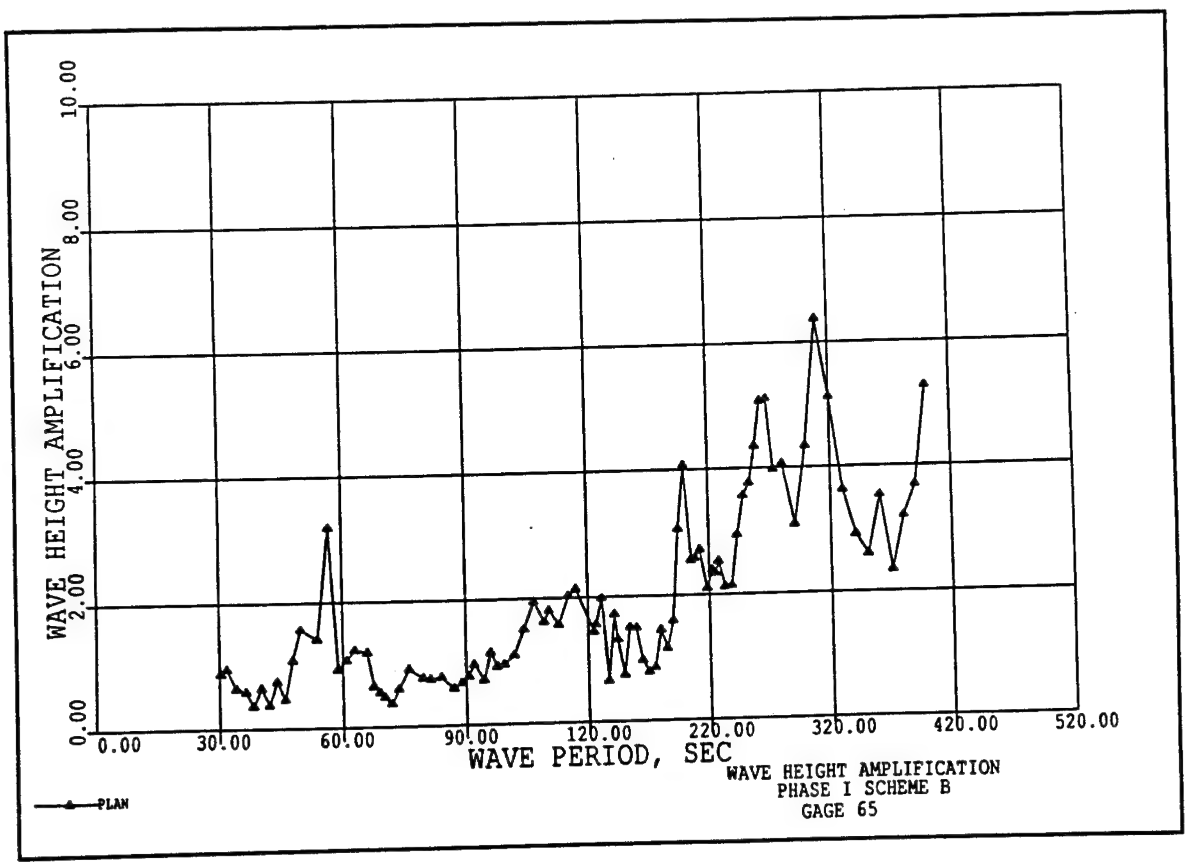

WAVE HEIGHT AMPLIFICATION
0.00
1.00
2.00
3.00
4.00
5.00
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
PLAN
WAVE HEIGHT AMPLIFICATION
PHASE I SCHEME B
GAGE 60

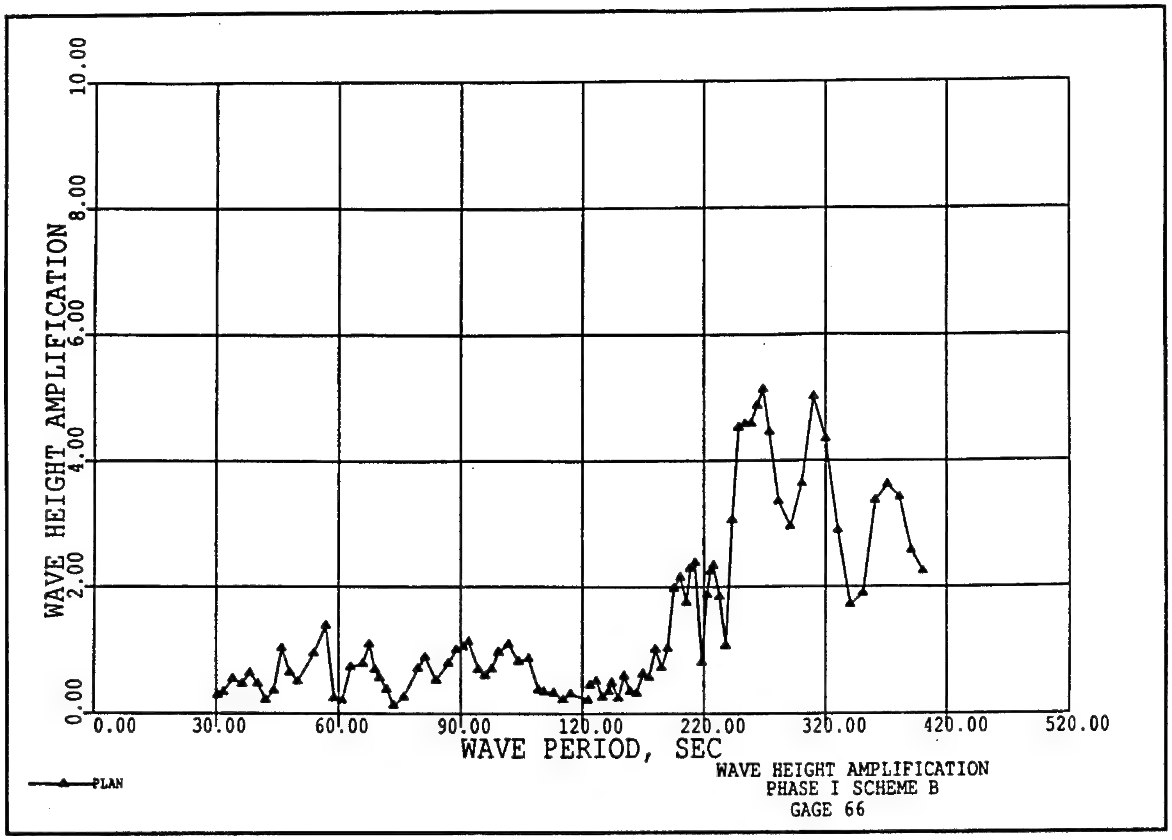

WAVE HEIGHT AMPLIFICATION
0.00
1.00
2.00
3.00
4.00
5.00
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
PLAN
WAVE HEIGHT AMPLIFICATION
PHASE I SCHEME B
GAGE 61

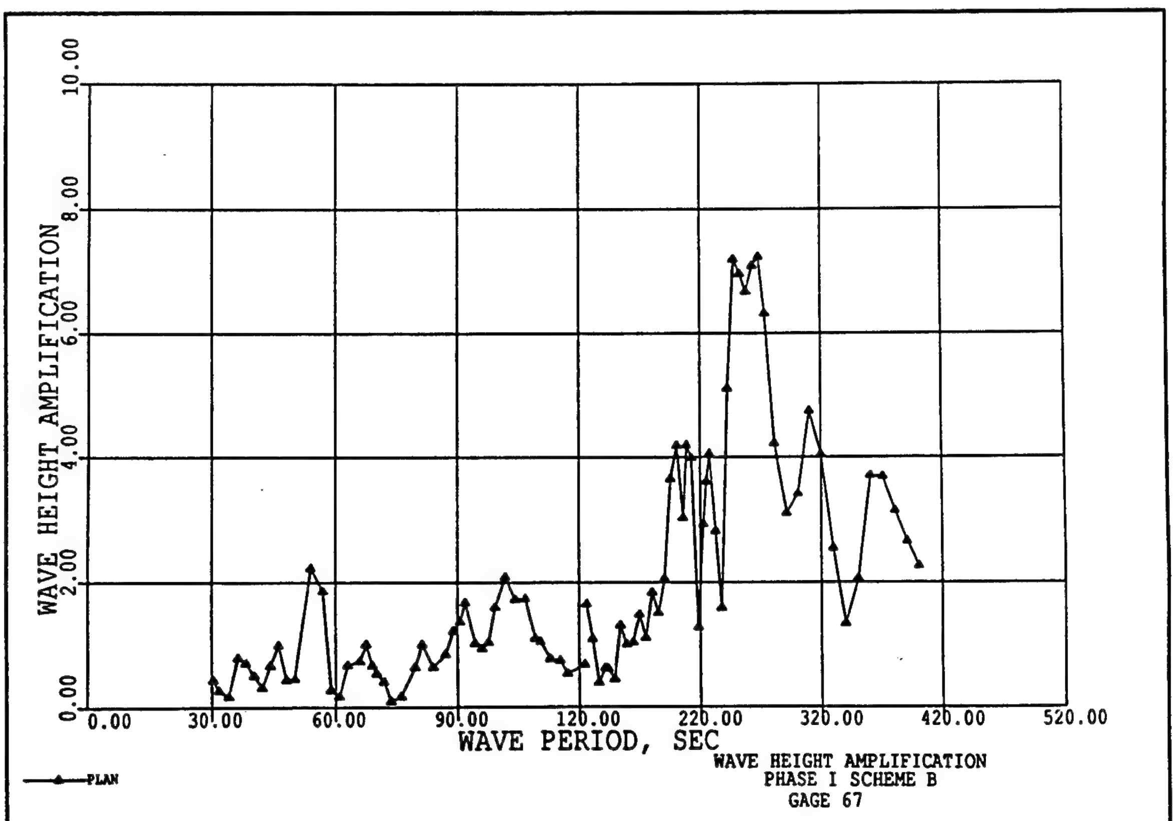

WAVE HEIGHT AMPLIFICATION
0.00
1.00
2.00
3.00
4.00
5.00
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
PLAN
WAVE HEIGHT AMPLIFICATION
PHASE I SCHEME B
GAGE 62

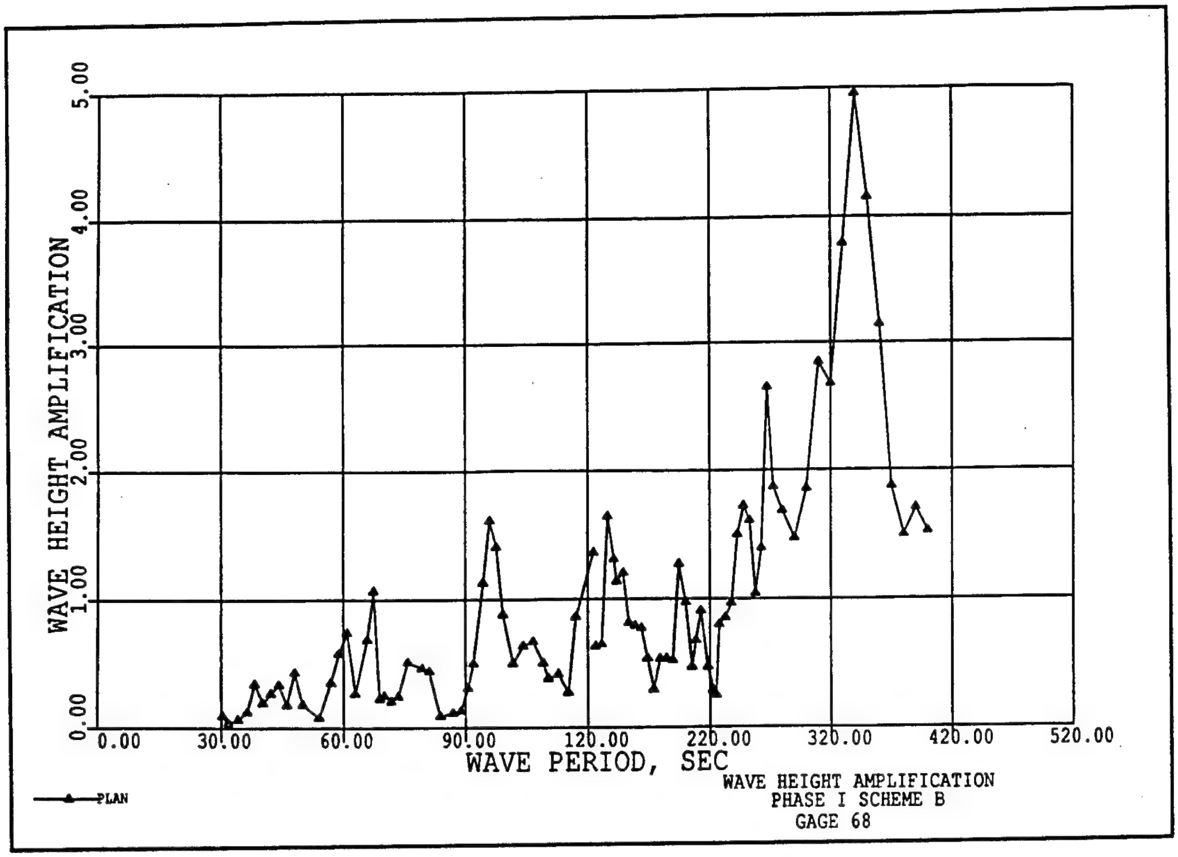

WAVE HEIGHT AMPLIFICATION
0.00
1.00
2.00
3.00
4.00
5.00
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
PLAN
WAVE HEIGHT AMPLIFICATION
PHASE I SCHEME B
GAGE 63

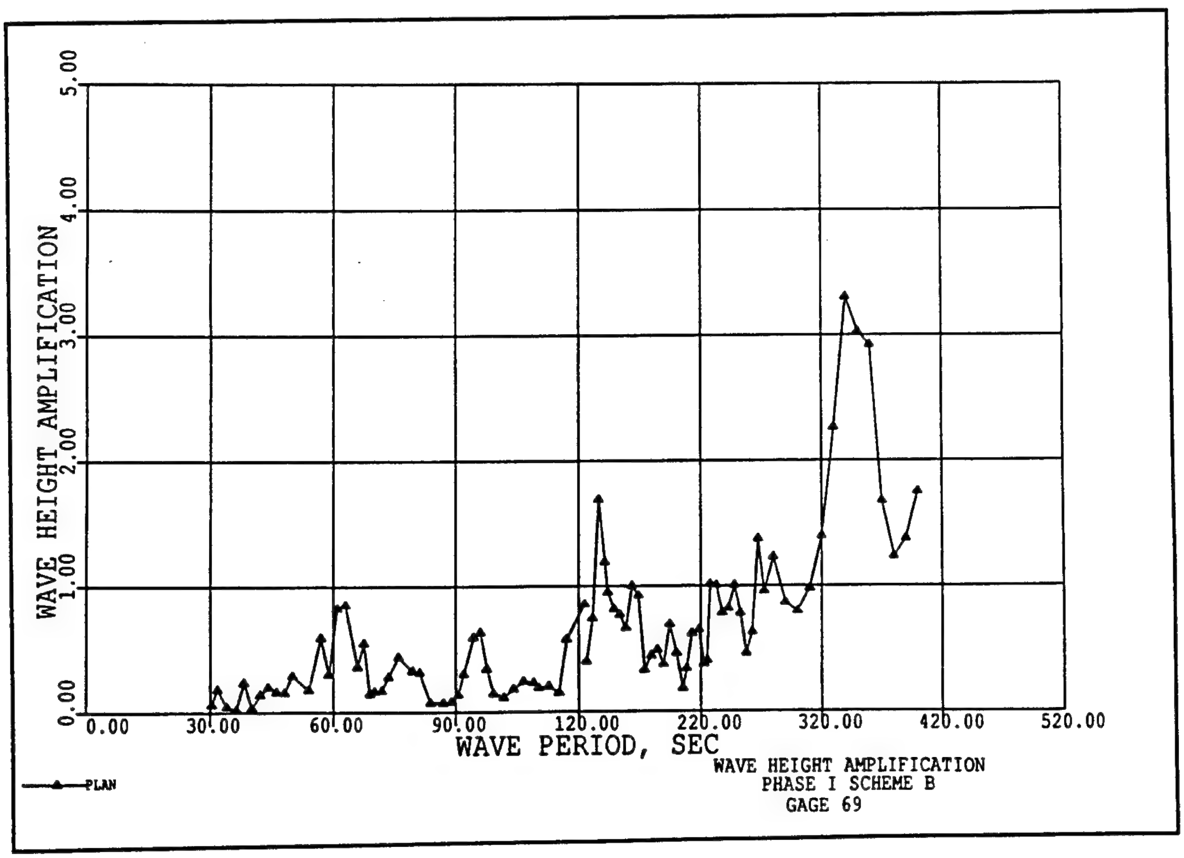

WAVE HEIGHT AMPLIFICATION
0.00
2.00
4.00
6.00
8.00
10.00
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
PLAN
WAVE HEIGHT AMPLIFICATION
PHASE I SCHEME B
GAGE 64

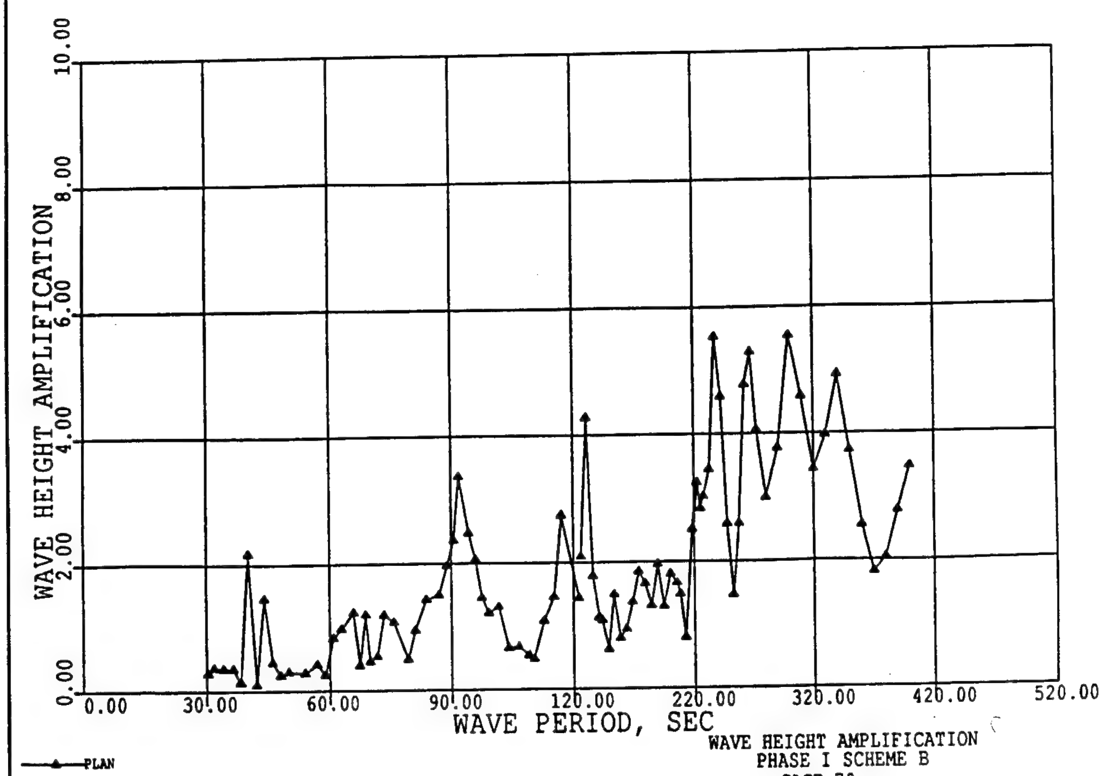

WAVE HEIGHT AMPLIFICATION
0.00
2.00
4.00
6.00
8.00
10.00
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
PLAN
WAVE HEIGHT AMPLIFICATION
PHASE I SCHEME B
GAGE 65


10.00
8.00
6.00
4.00
2.00
0.00
WAVE HEIGHT AMPLIFICATION
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
PLAN
WAVE HEIGHT AMPLIFICATION
PHASE I SCHEME B
GAGE 66

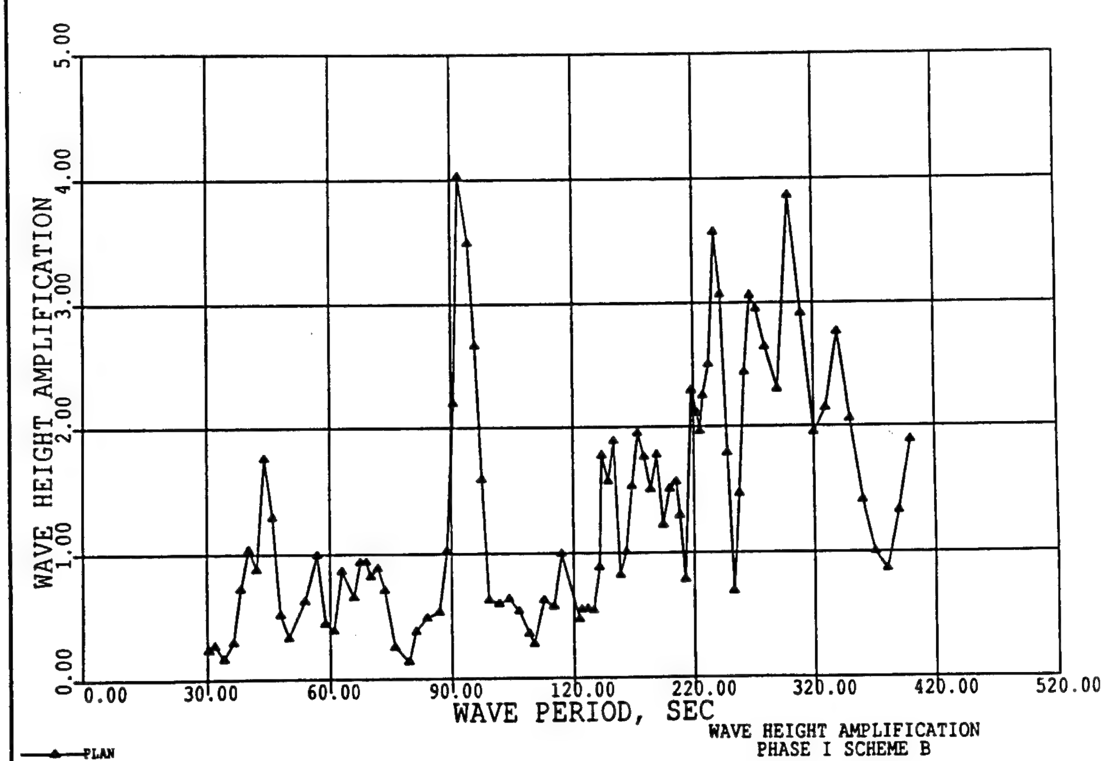

10.00
8.00
6.00
4.00
2.00
0.00
WAVE HEIGHT AMPLIFICATION
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
PLAN
WAVE HEIGHT AMPLIFICATION
PHASE I SCHEME B
GAGE 67


WAVE HEIGHT AMPLIFICATION
0.00
1.00
2.00
3.00
4.00
5.00
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
PLAN
WAVE HEIGHT AMPLIFICATION
PHASE I SCHEME B
GAGE 68

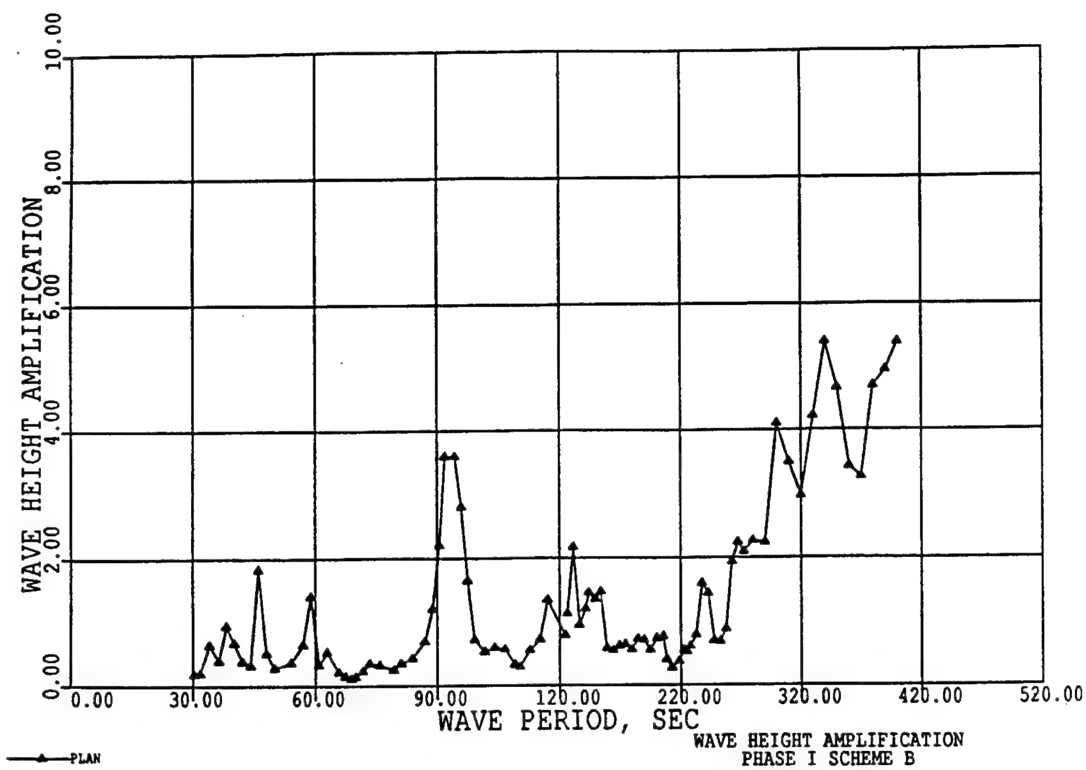

WAVE HEIGHT AMPLIFICATION
0.00
1.00
2.00
3.00
4.00
5.00
0.00
30.00
60.00
90.00
120.00
220.00
320.00
420.00
520.00
WAVE PERIOD, SEC
PLAN
WAVE HEIGHT AMPLIFICATION
PHASE I SCHEME B
GAGE 69



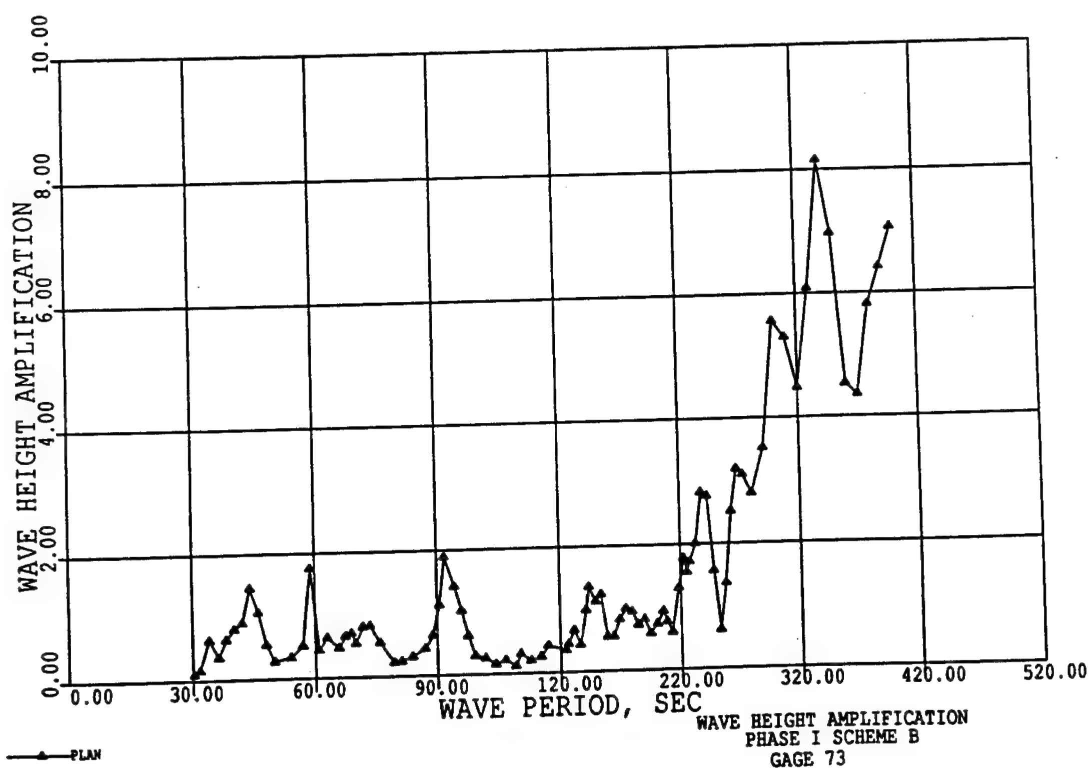

WAVE HEIGHT AMPLIFICATION
PHASE I SCHEME B
GAGE 70




WAVE HEIGHT AMPLIFICATION
PHASE I SCHEME B
GAGE 71

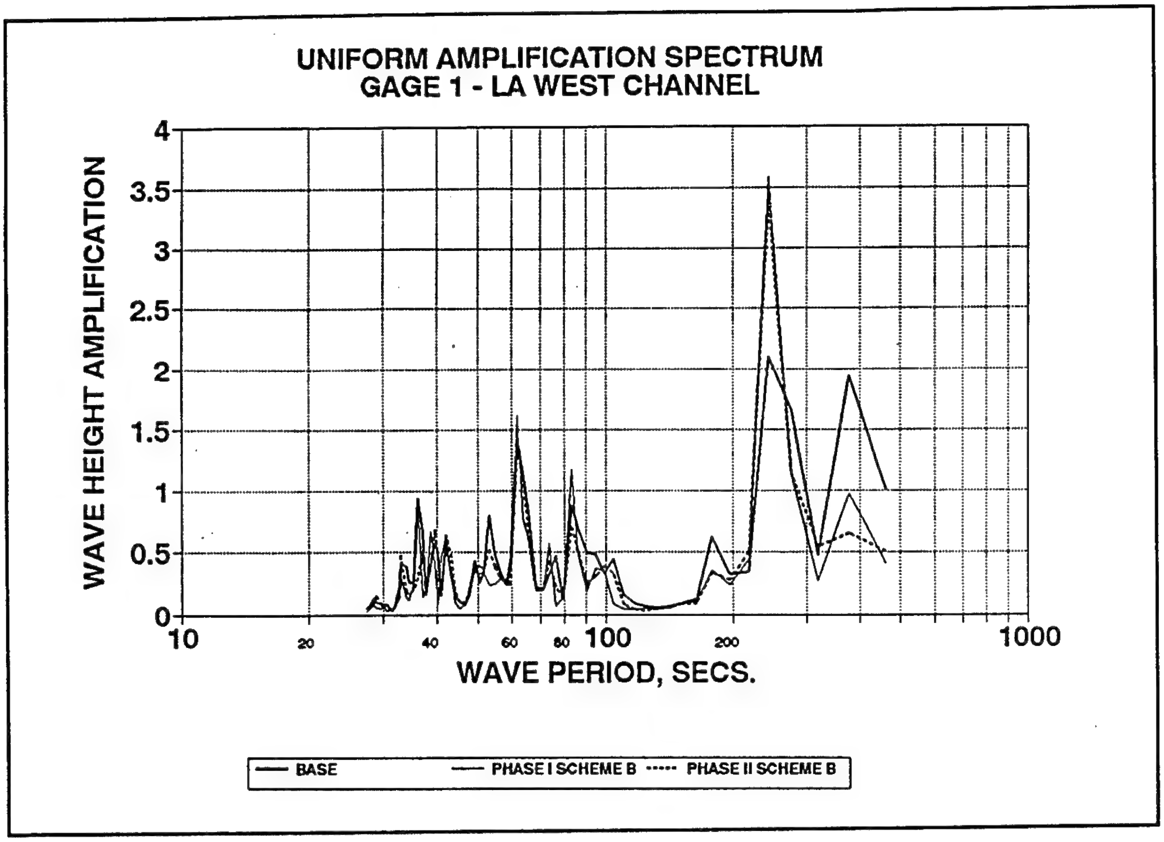


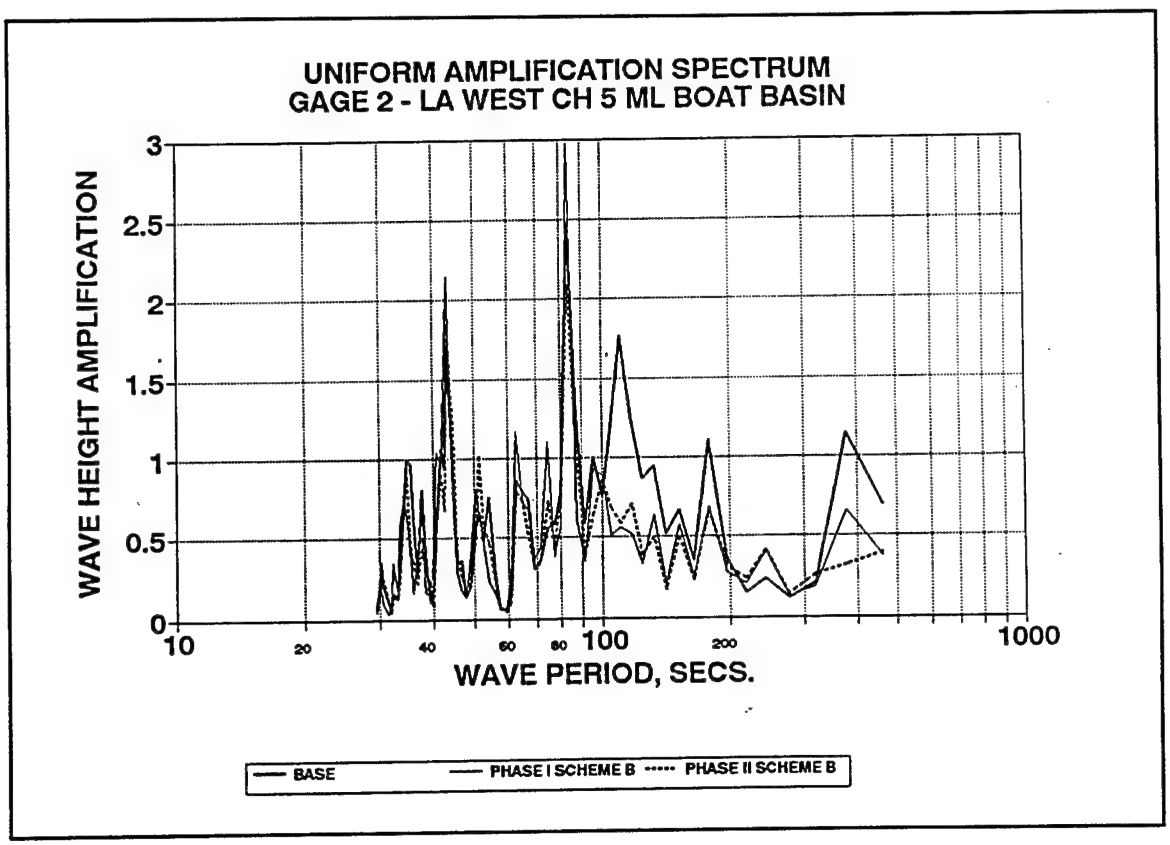

WAVE HEIGHT AMPLIFICATION
PHASE I SCHEME B
GAGE 72

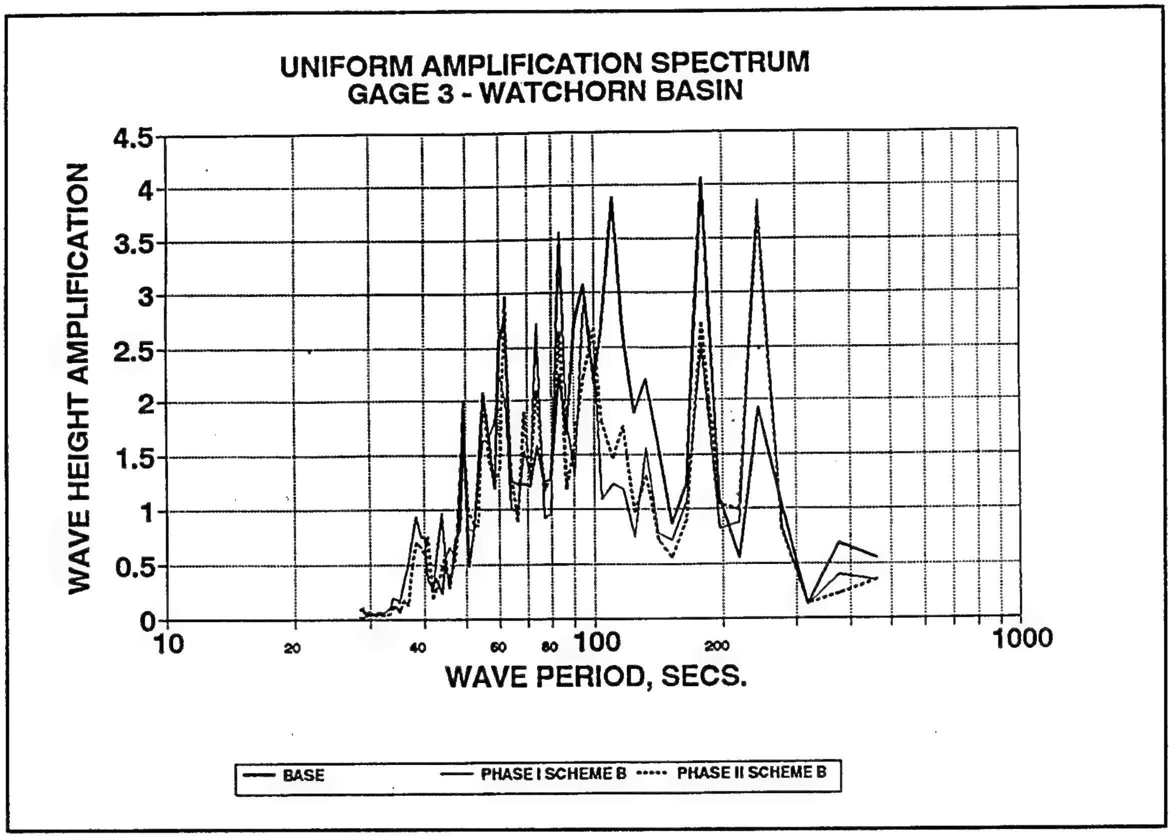


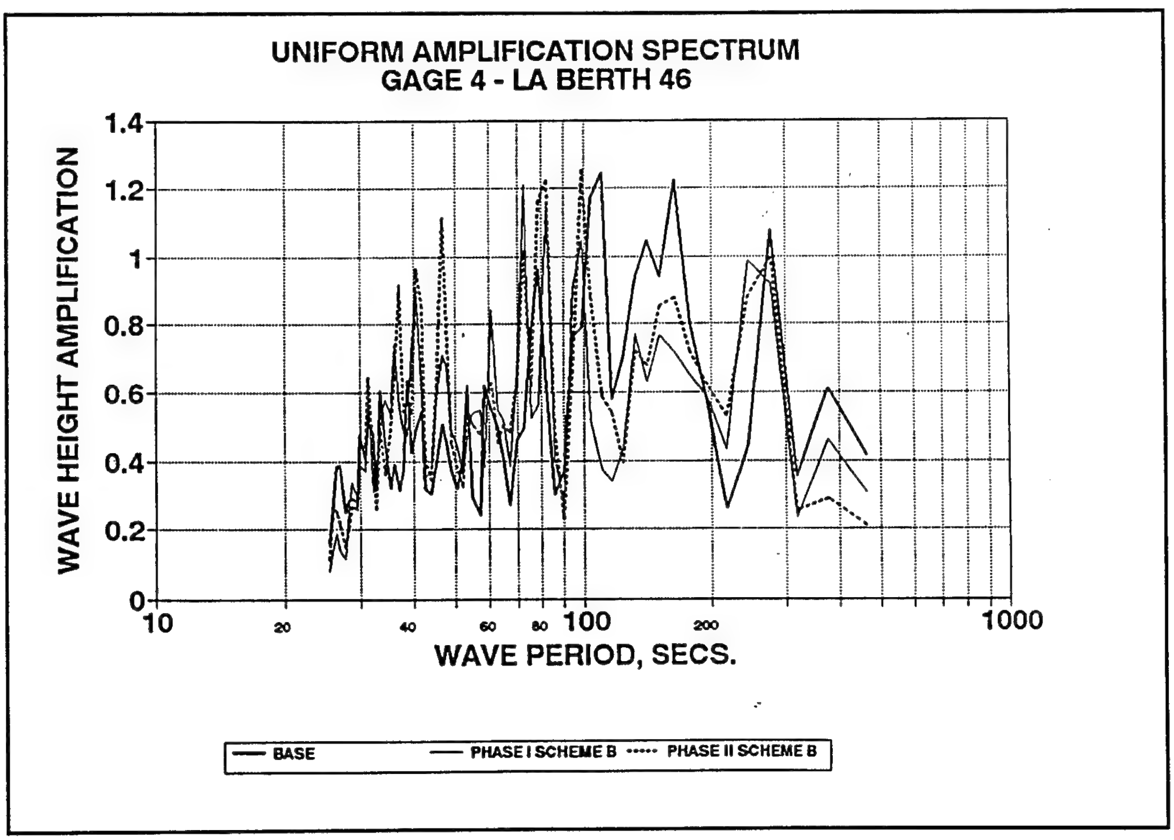

WAVE HEIGHT AMPLIFICATION
PHASE I SCHEME B
GAGE 73

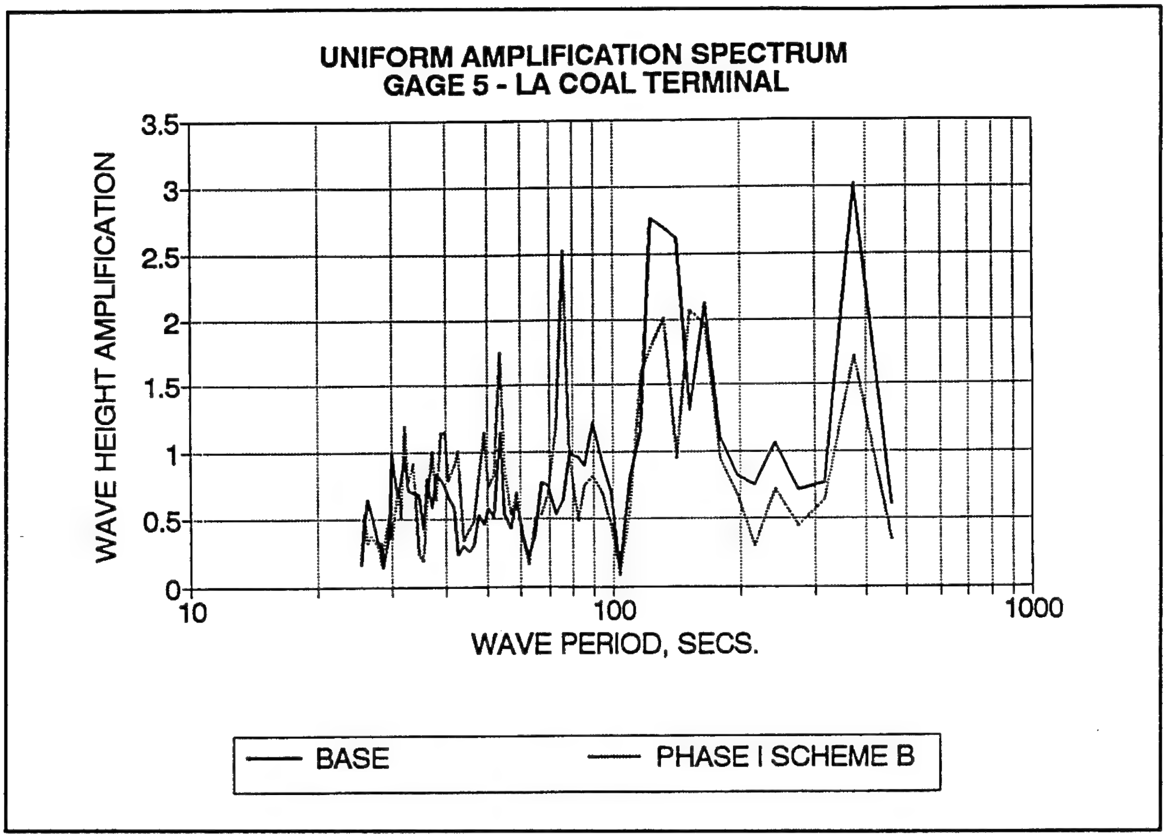
# Appendix B
# Uniform Spectrum Test Results (Phases I and II, Scheme B)

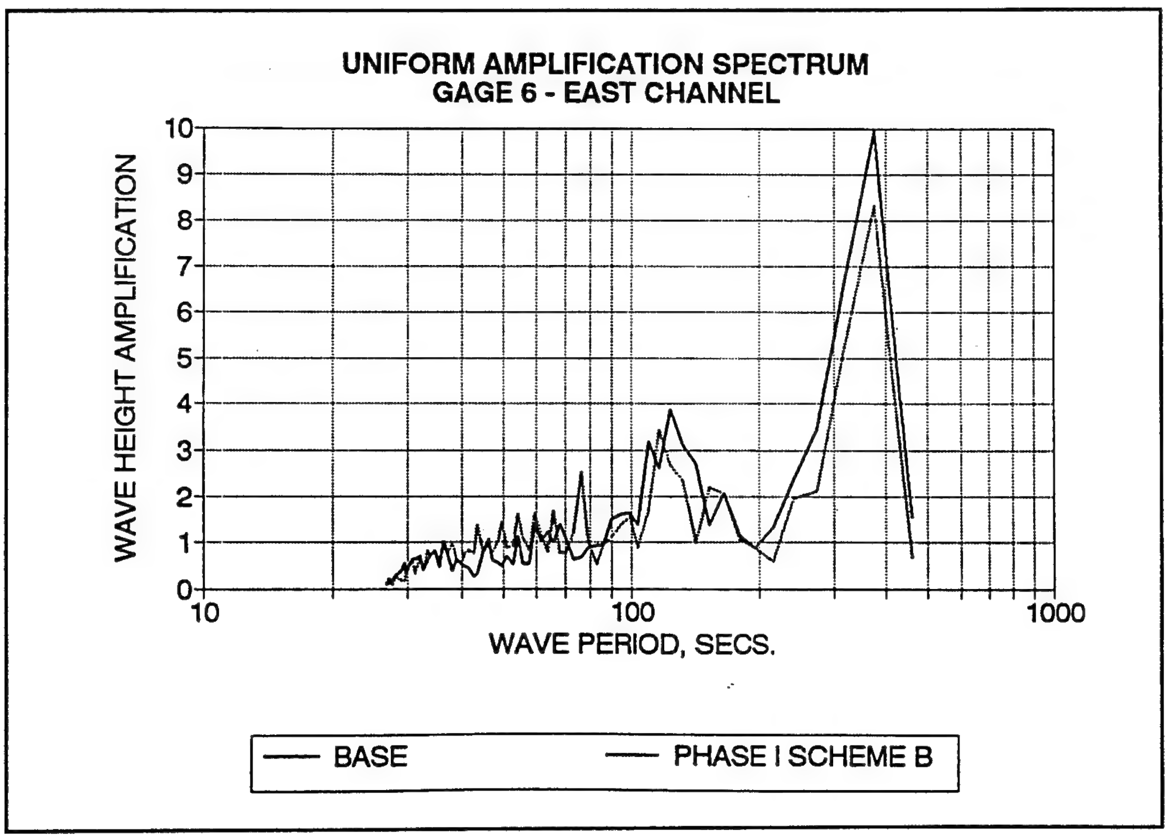

UNIFORM AMPLIFICATION SPECTRUM
GAGE 1 - LA WEST CHANNEL
WAVE HEIGHT AMPLIFICATION
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

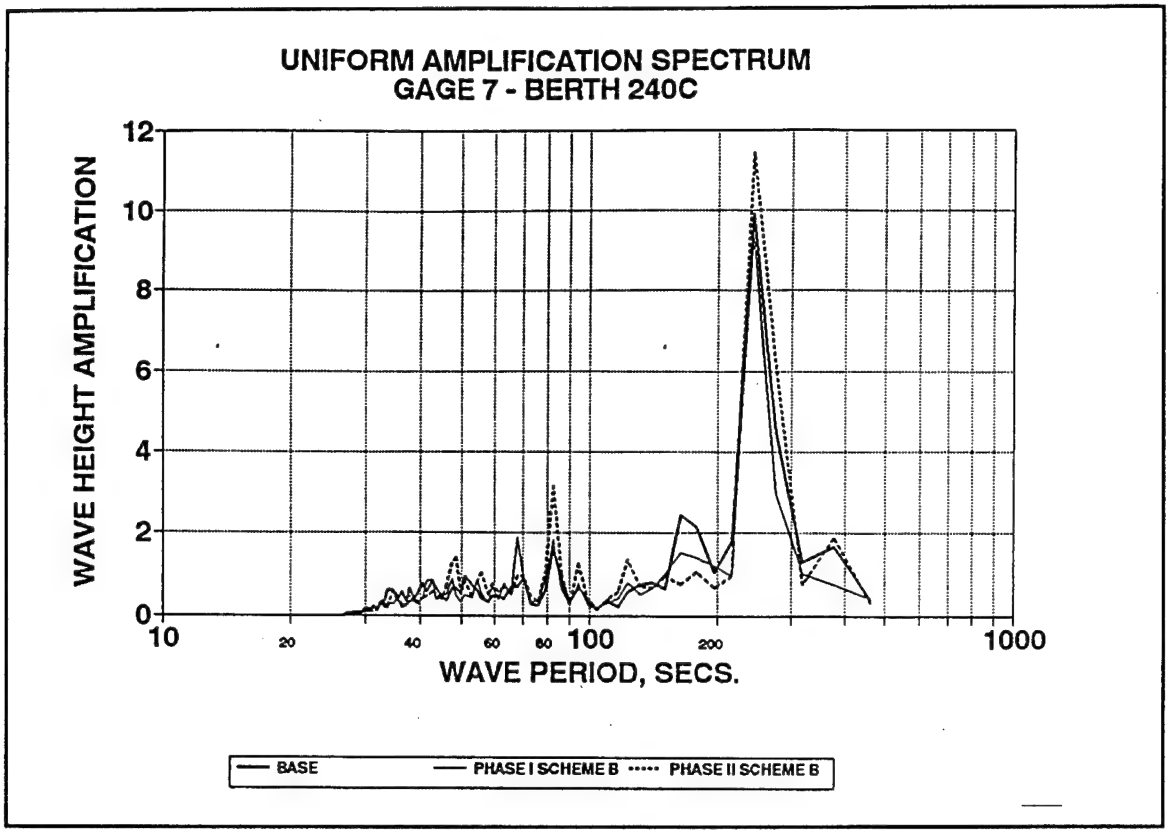

UNIFORM AMPLIFICATION SPECTRUM
GAGE 2 - LA WEST CH 5 ML BOAT BASIN
WAVE HEIGHT AMPLIFICATION
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

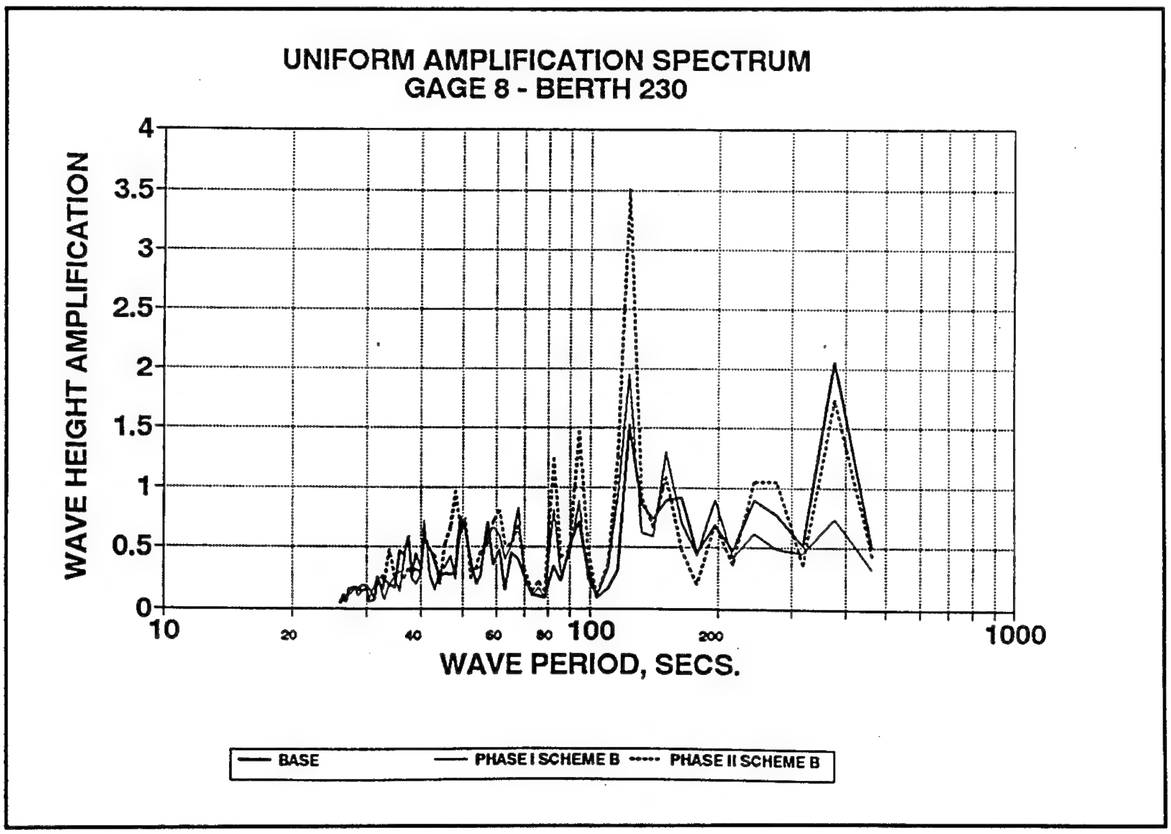

UNIFORM AMPLIFICATION SPECTRUM
GAGE 3 - WATCHORN BASIN
WAVE HEIGHT AMPLIFICATION
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

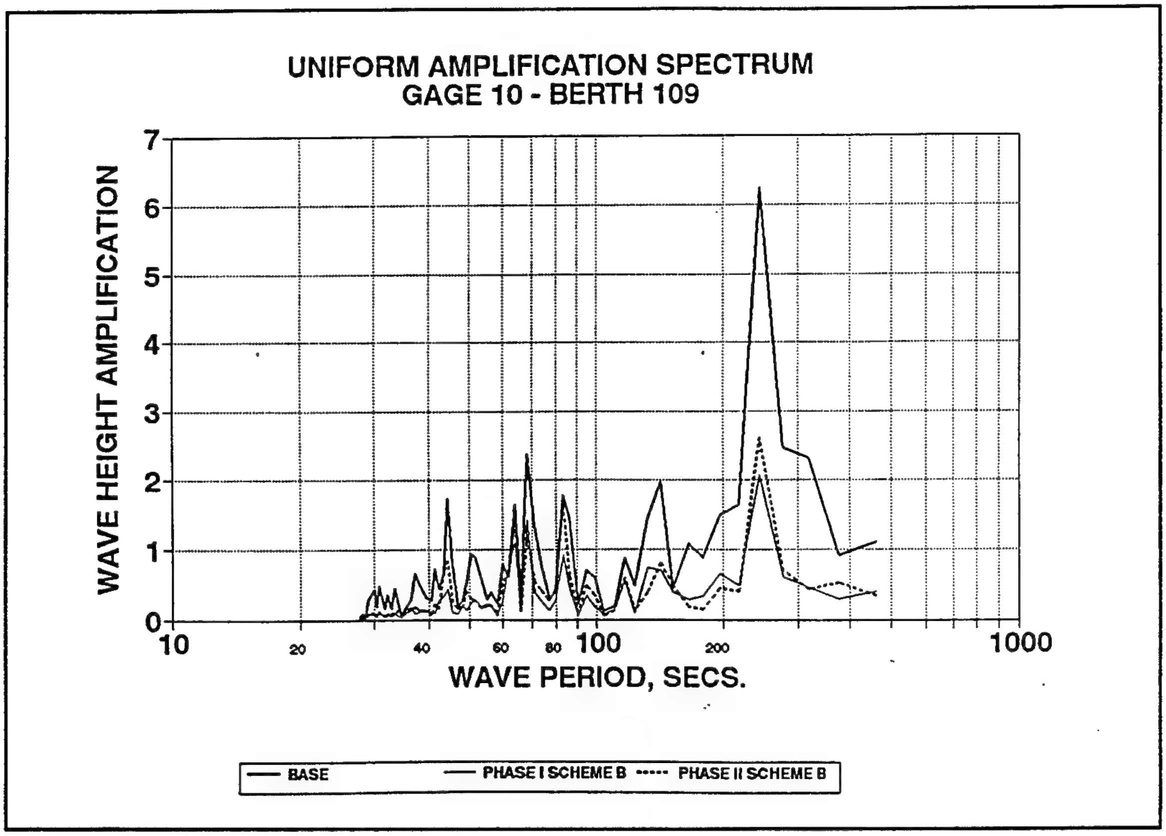

UNIFORM AMPLIFICATION SPECTRUM
GAGE 4 - LA BERTH 46
WAVE HEIGHT AMPLIFICATION
1.4
1.2
1
0.8
0.6
0.4
0.2
0
10
20
40
60
80
100
200
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

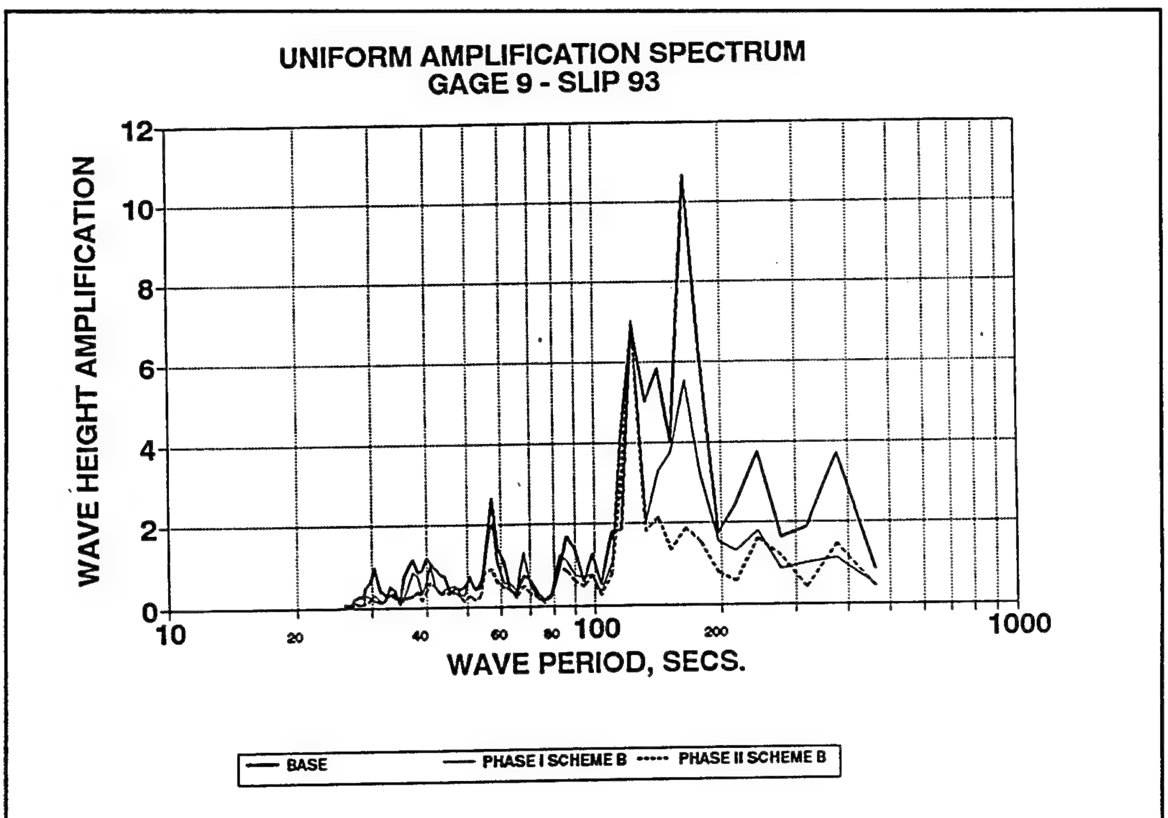

UNIFORM AMPLIFICATION SPECTRUM
GAGE 5 - LA COAL TERMINAL
WAVE HEIGHT AMPLIFICATION
3.5
3
2.5
2
1.5
1
0.5
0
10
100
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B

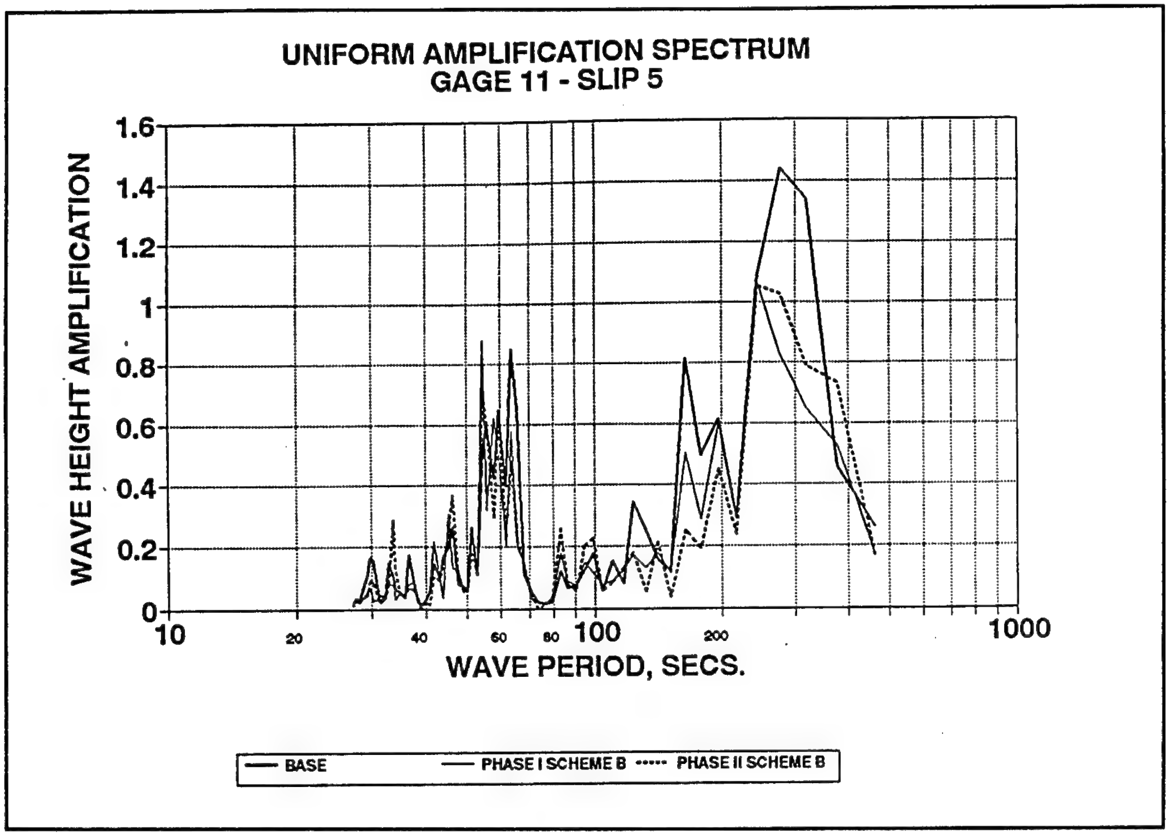

UNIFORM AMPLIFICATION SPECTRUM
GAGE 6 - EAST CHANNEL
WAVE HEIGHT AMPLIFICATION
10
9
8
7
6
5
4
3
2
1
0
10
100
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B

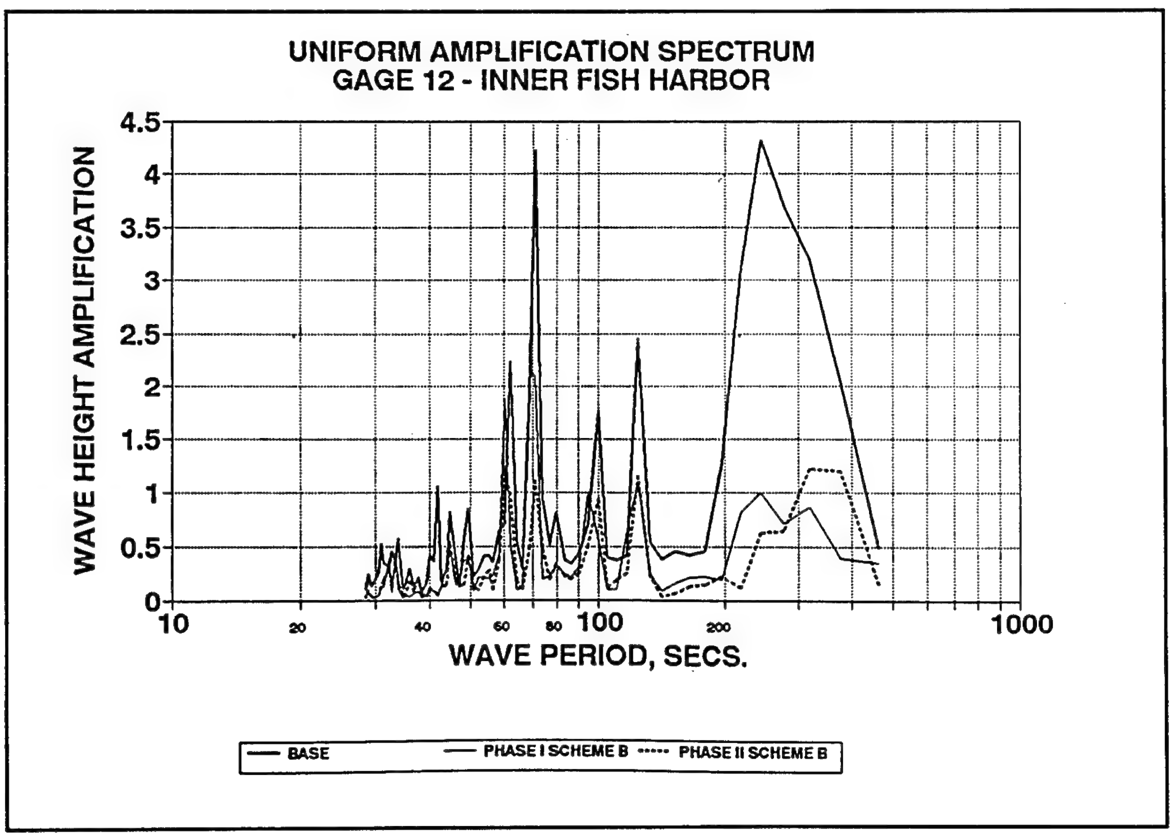

UNIFORM AMPLIFICATION SPECTRUM
GAGE 7 - BERTH 240C
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

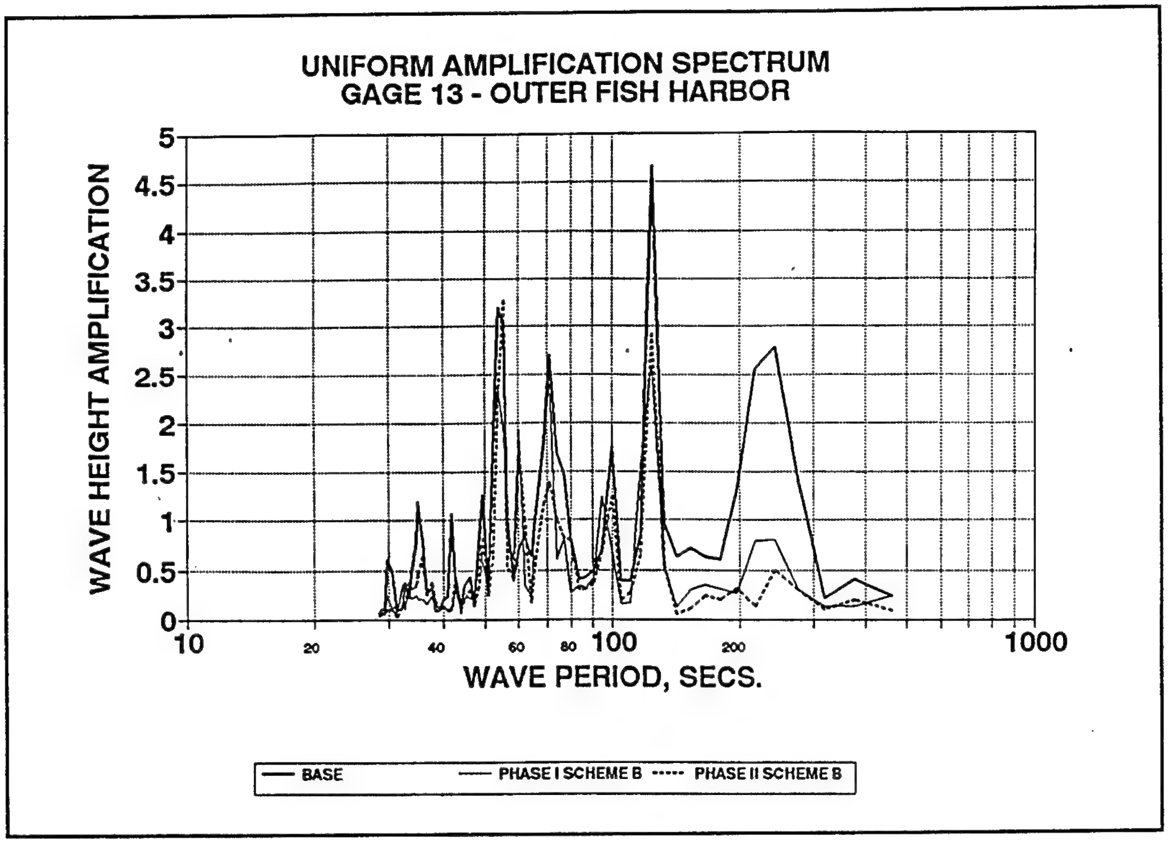

UNIFORM AMPLIFICATION SPECTRUM
GAGE 8 - BERTH 230
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B


UNIFORM AMPLIFICATION SPECTRUM
GAGE 10 - BERTH 109
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
7
10
20
40
60
80
100
200
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

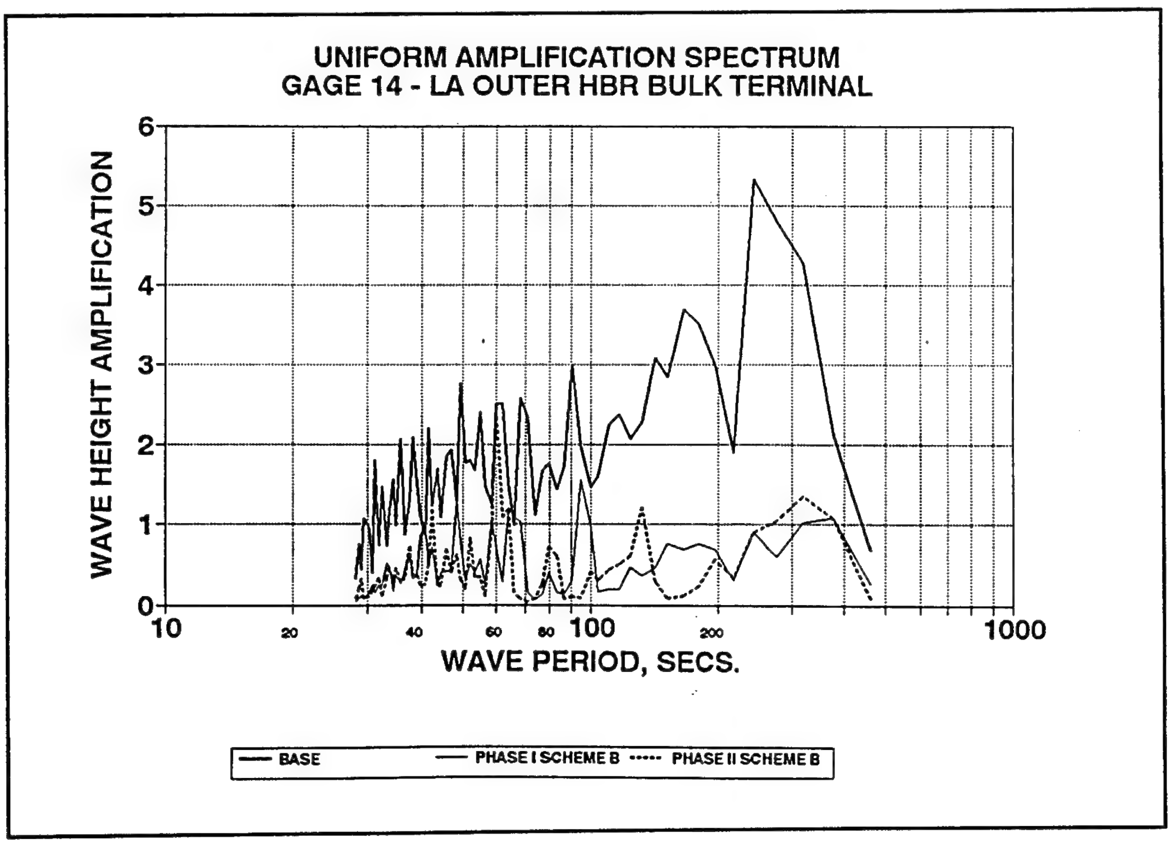

UNIFORM AMPLIFICATION SPECTRUM
GAGE 9 - SLIP 93
WAVE HEIGHT AMPLIFICATION
0
2
4
6
8
10
12
10
20
40
60
80
100
200
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B


UNIFORM AMPLIFICATION SPECTRUM
GAGE 11 - SLIP 5
WAVE HEIGHT AMPLIFICATION
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
10
20
40
60
80
100
200
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

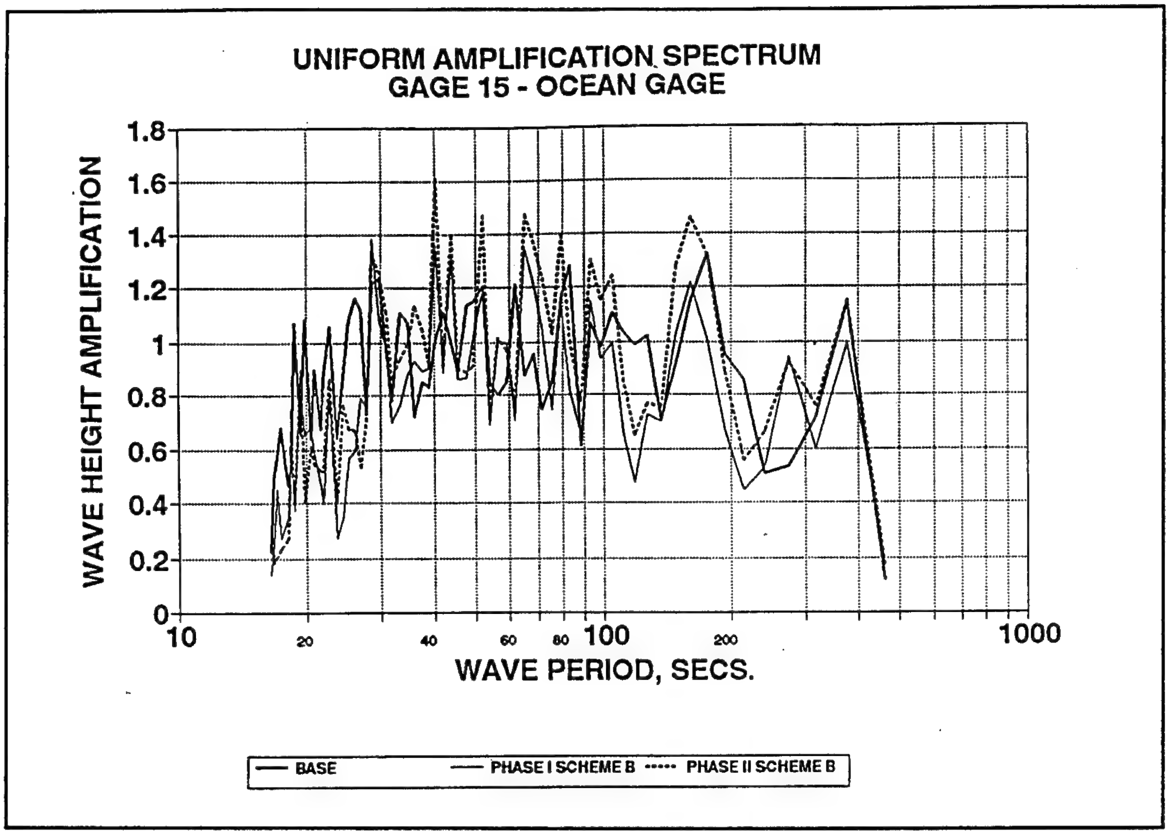

UNIFORM AMPLIFICATION SPECTRUM
GAGE 12 - INNER FISH HARBOR
WAVE HEIGHT AMPLIFICATION
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B



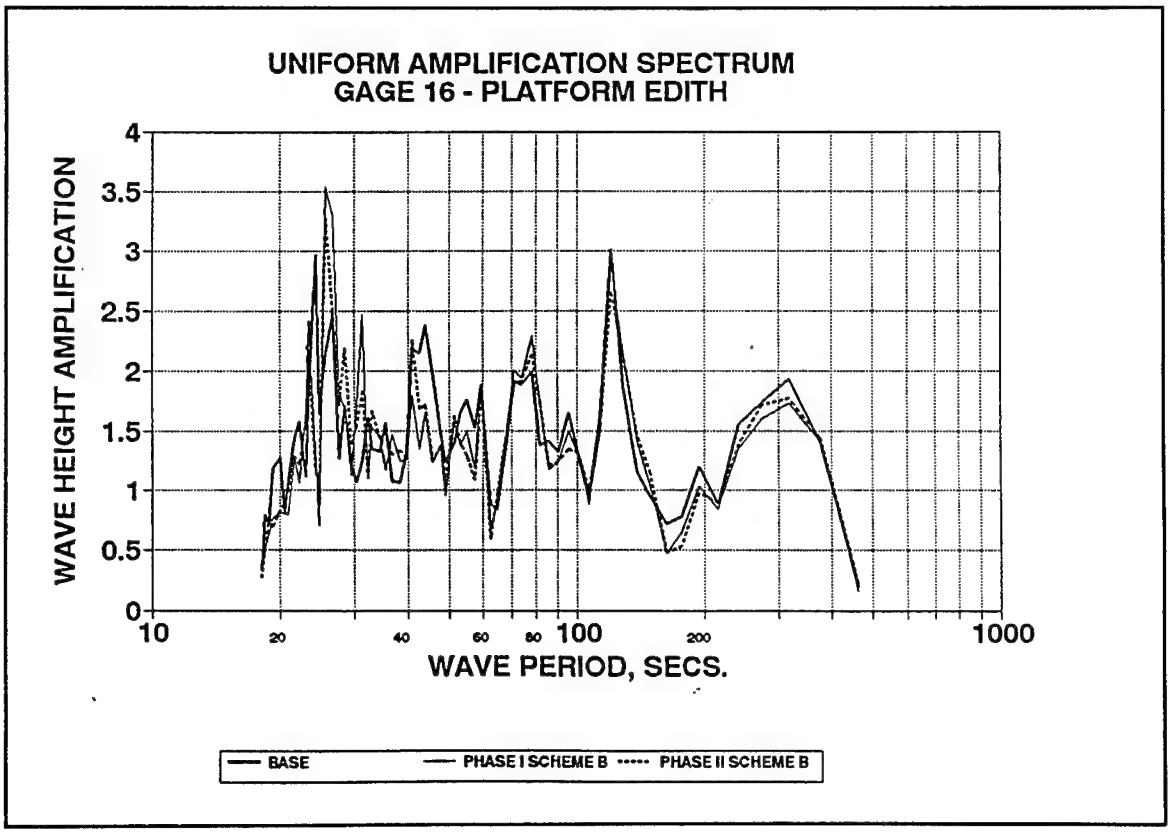
UNIFORM AMPLIFICATION SPECTRUM
GAGE 13 - OUTER FISH HARBOR
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
10
20
40
60
80
100
200
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

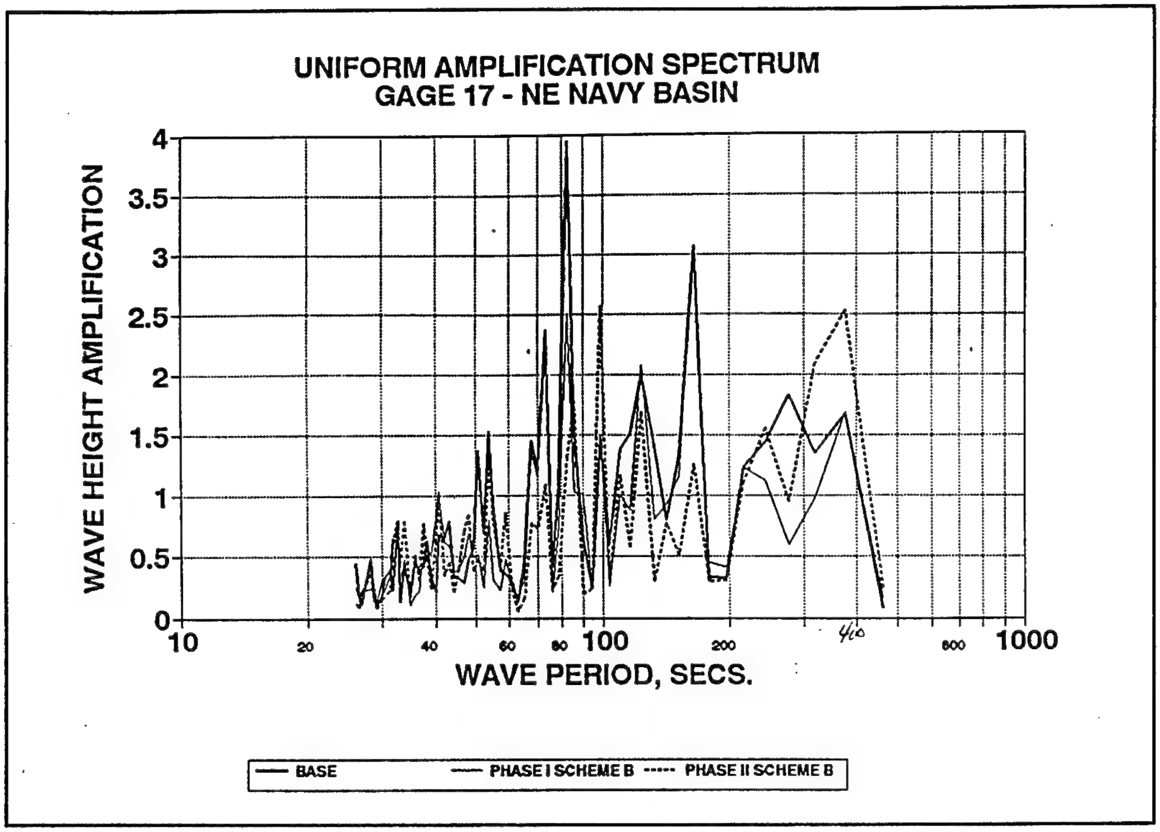
UNIFORM AMPLIFICATION SPECTRUM
GAGE 14 - LA OUTER HBR BULK TERMINAL
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
10
20
40
60
80
100
200
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

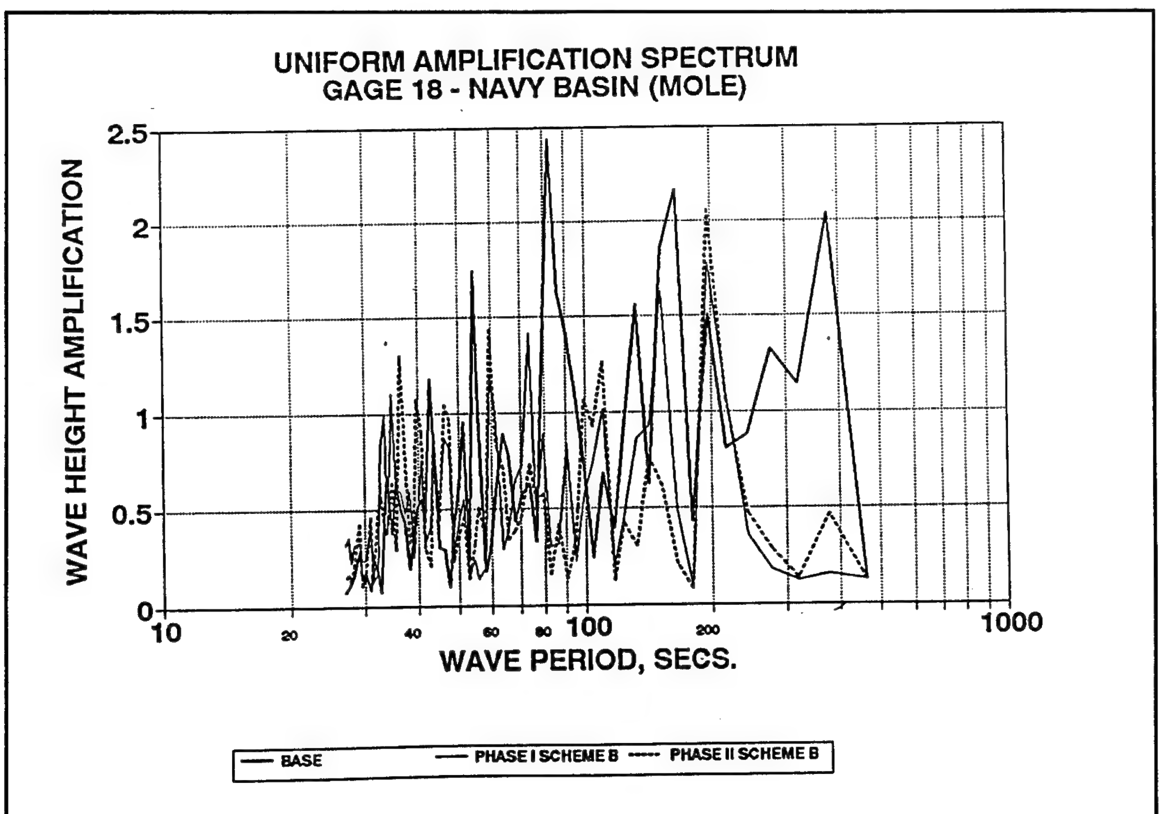


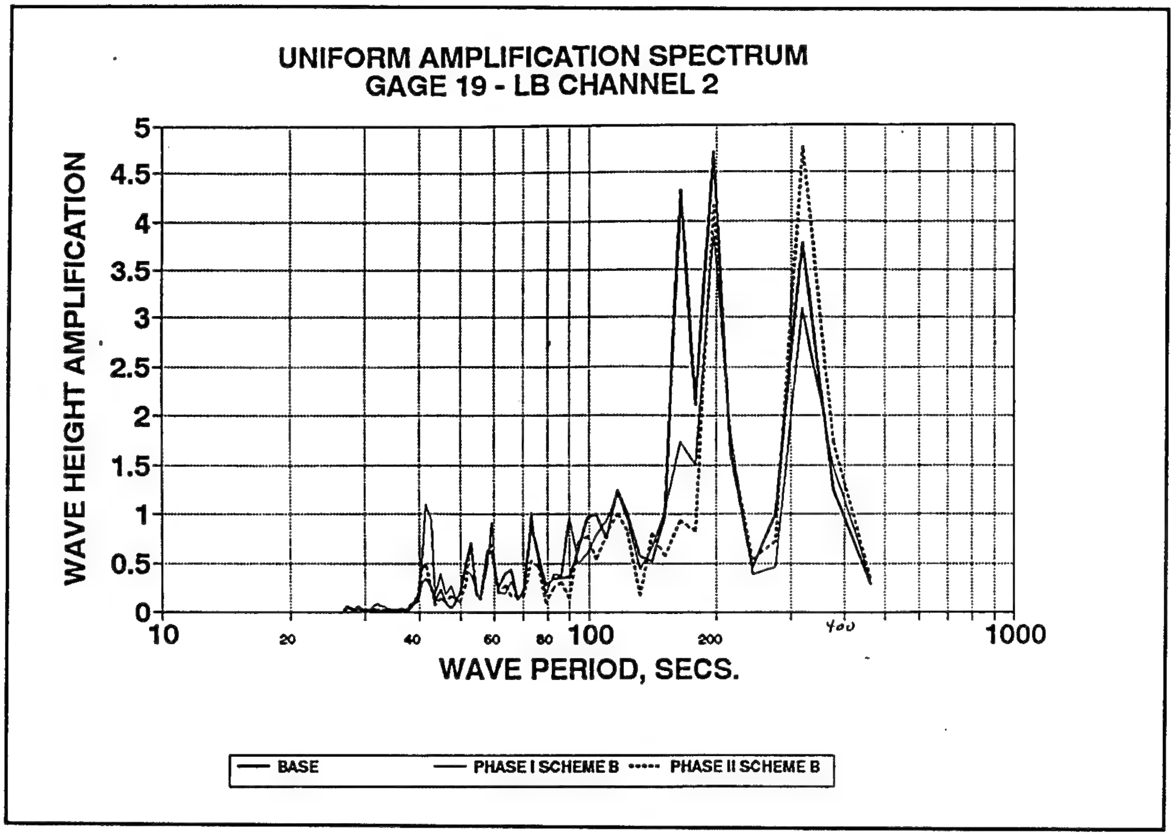
UNIFORM AMPLIFICATION SPECTRUM
GAGE 15 - OCEAN GAGE
WAVE HEIGHT AMPLIFICATION
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
10
20
40
60
80
100
200
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

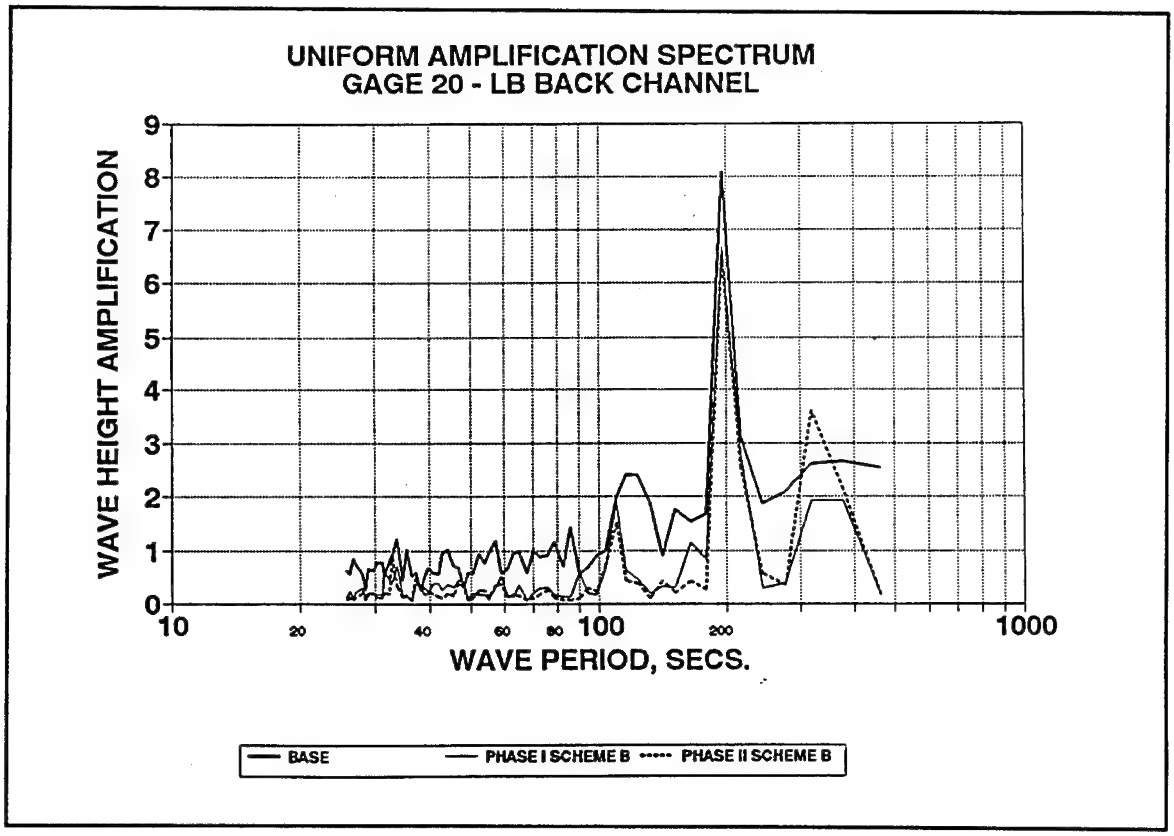



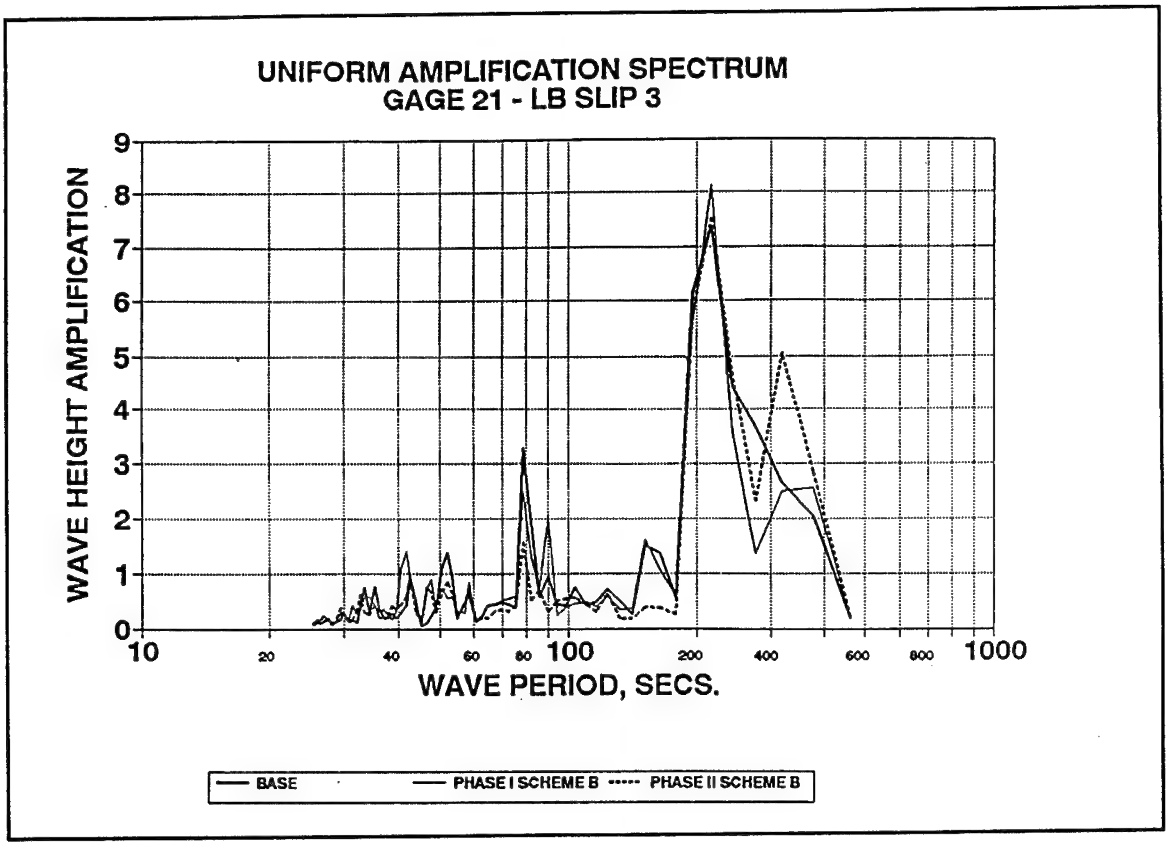
UNIFORM AMPLIFICATION SPECTRUM
GAGE 16 - PLATFORM EDITH
WAVE HEIGHT AMPLIFICATION
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

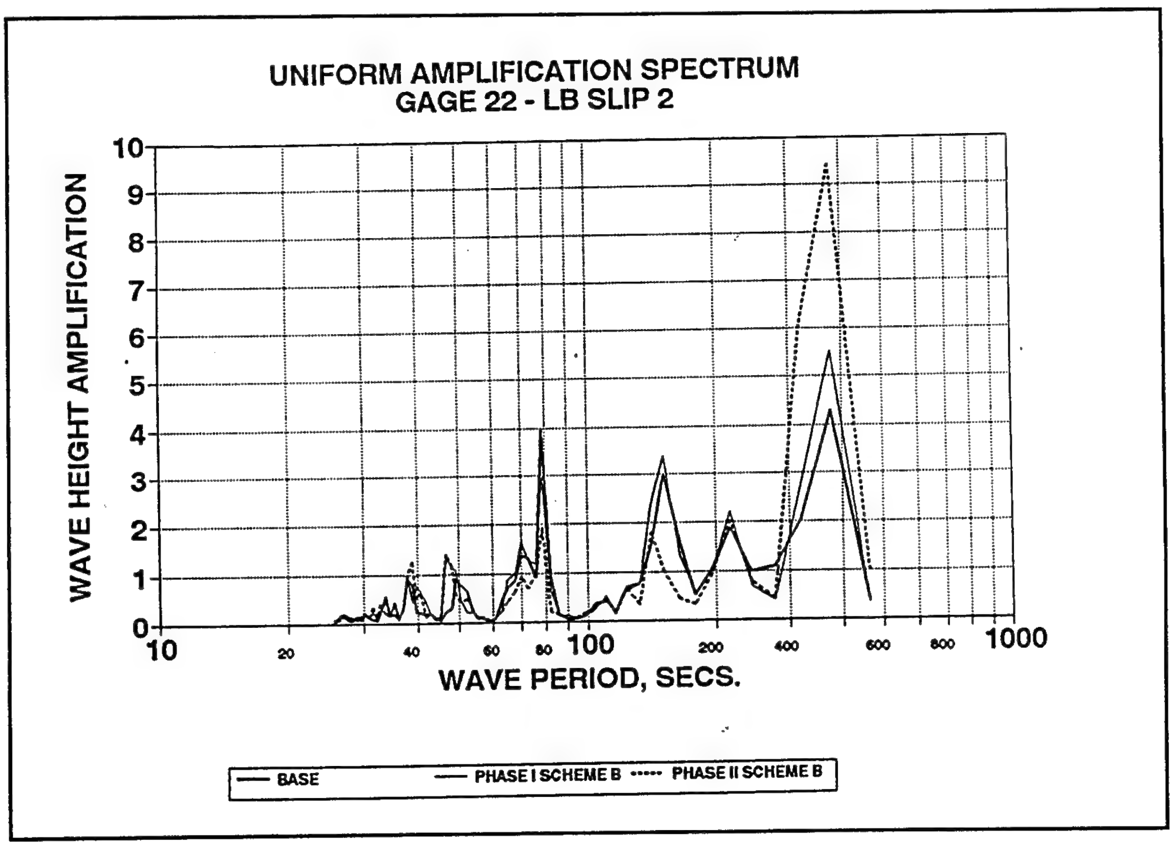

UNIFORM AMPLIFICATION SPECTRUM
GAGE 17 - NE NAVY BASIN
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
4
10
20
40
60
80
100
200
400
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

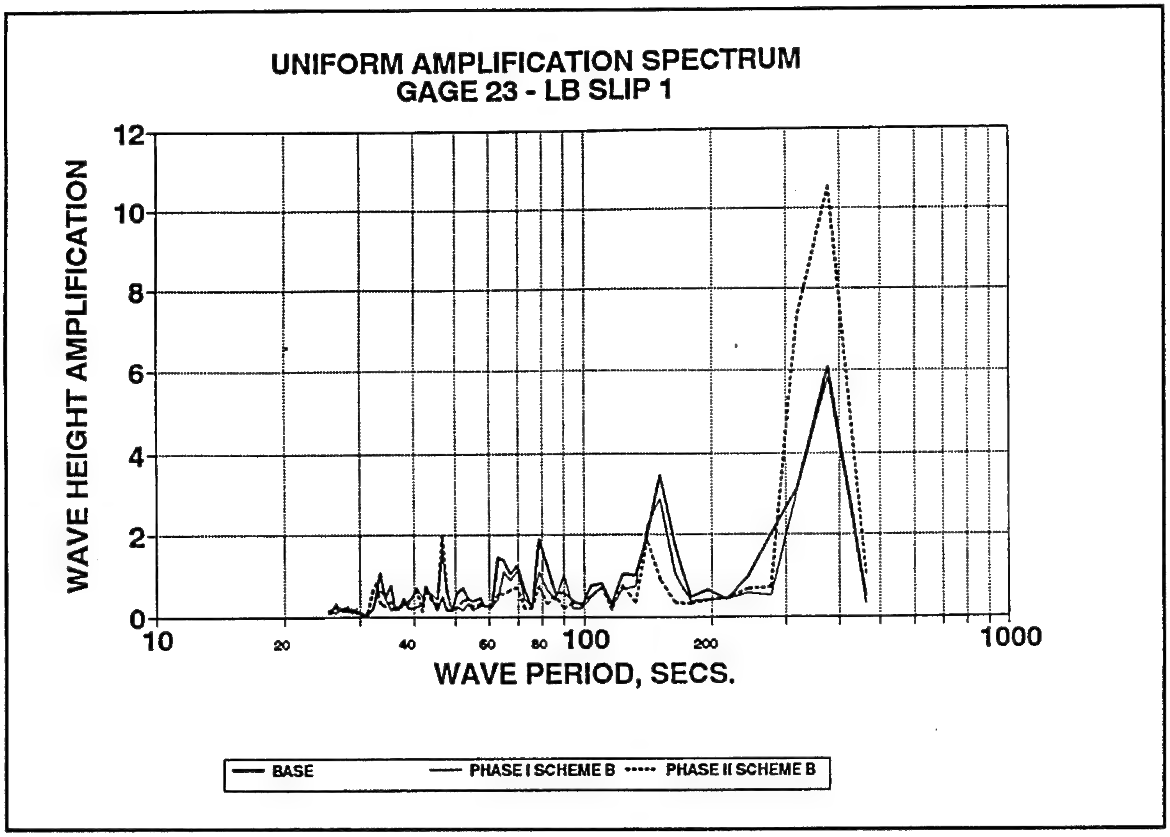

UNIFORM AMPLIFICATION SPECTRUM
GAGE 18 - NAVY BASIN (MOLE)
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
10
20
40
60
80
100
200
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

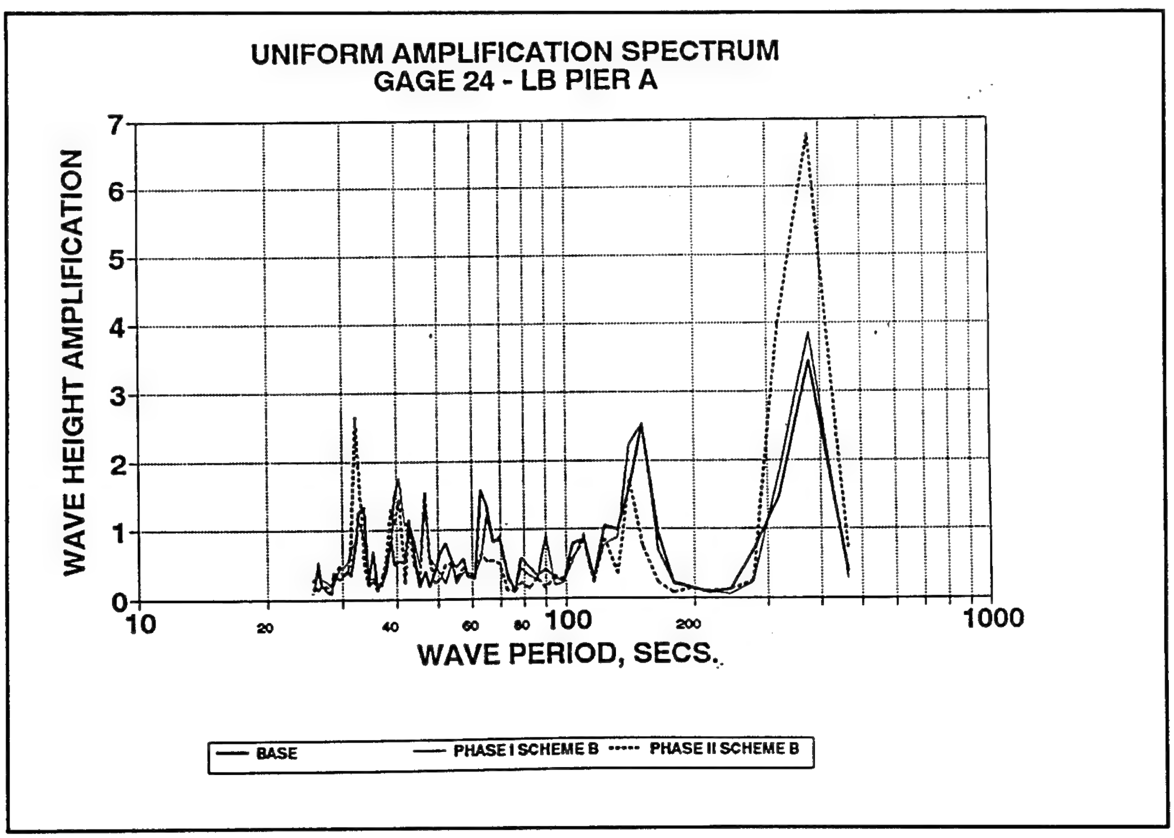

UNIFORM AMPLIFICATION SPECTRUM
GAGE 19 - LB CHANNEL 2
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
10
20
40
60
80
100
200
400
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

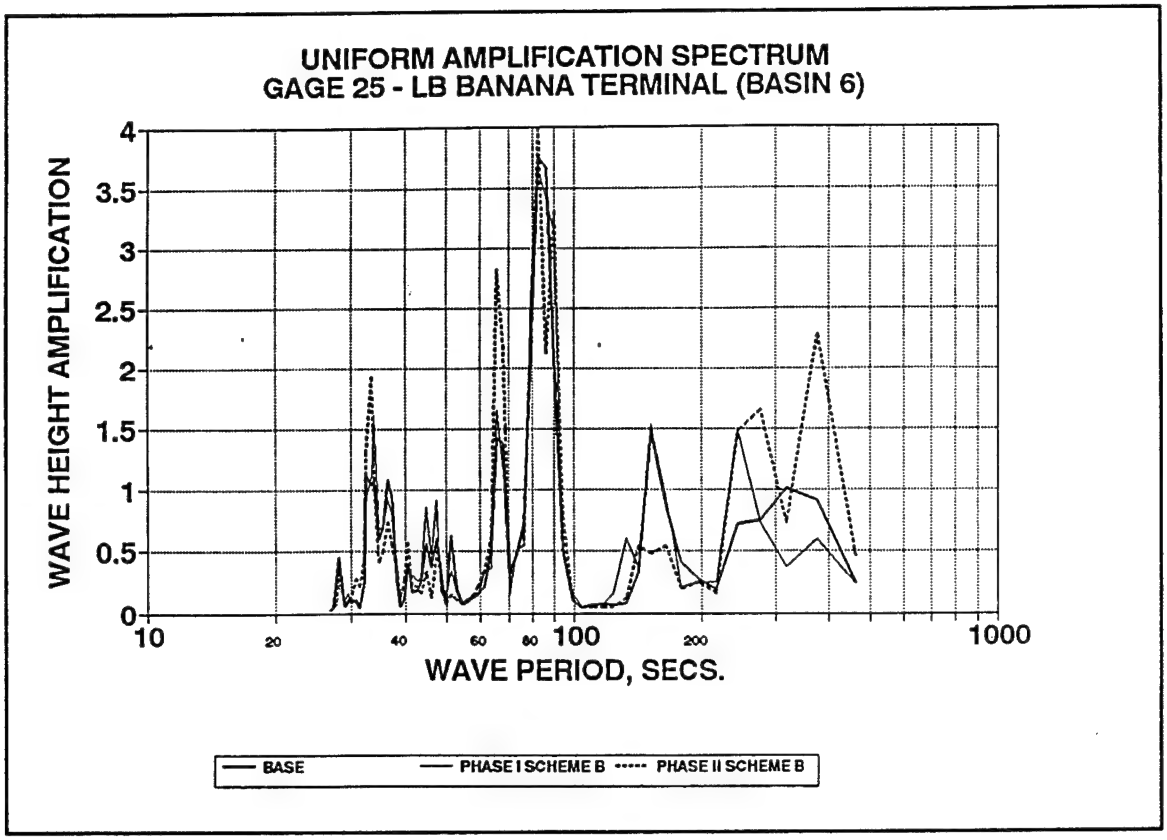

UNIFORM AMPLIFICATION SPECTRUM
GAGE 20 - LB BACK CHANNEL
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
7
8
9
10
20
40
60
80
100
200
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

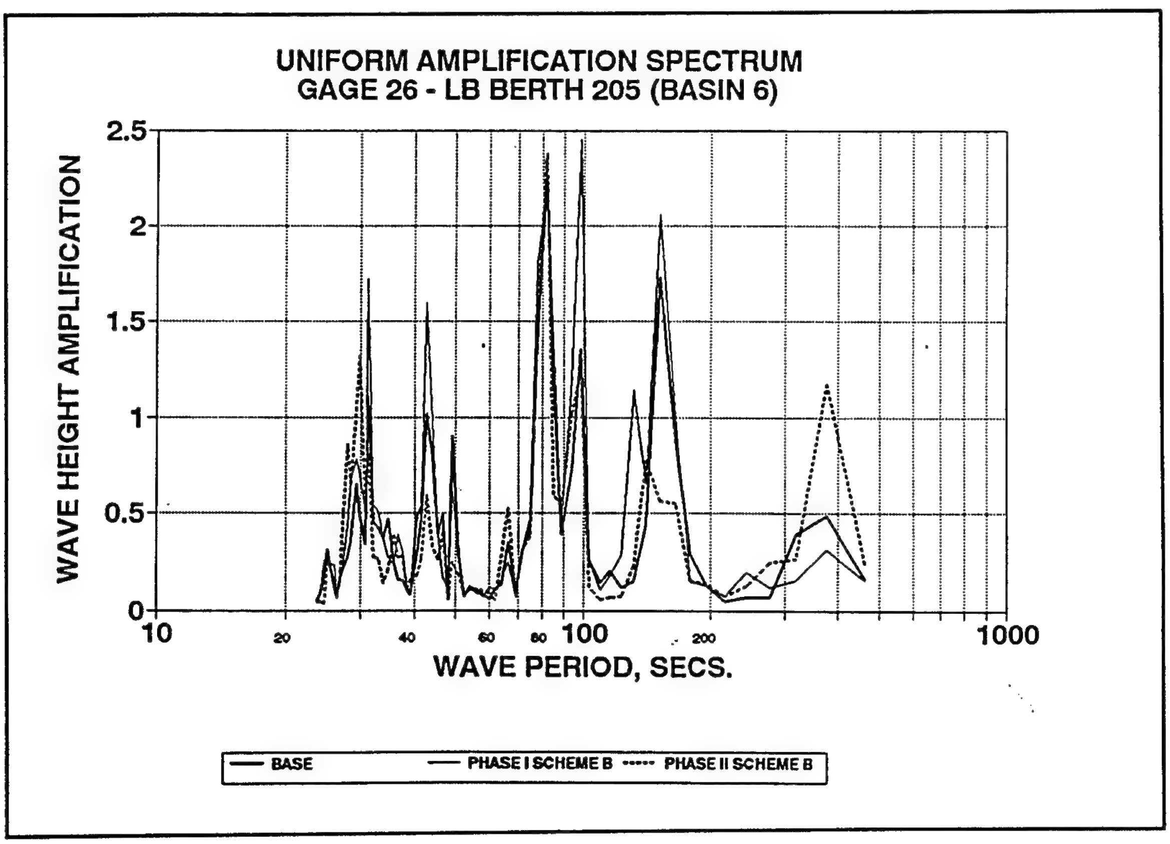

UNIFORM AMPLIFICATION SPECTRUM
GAGE 21 - LB SLIP 3
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

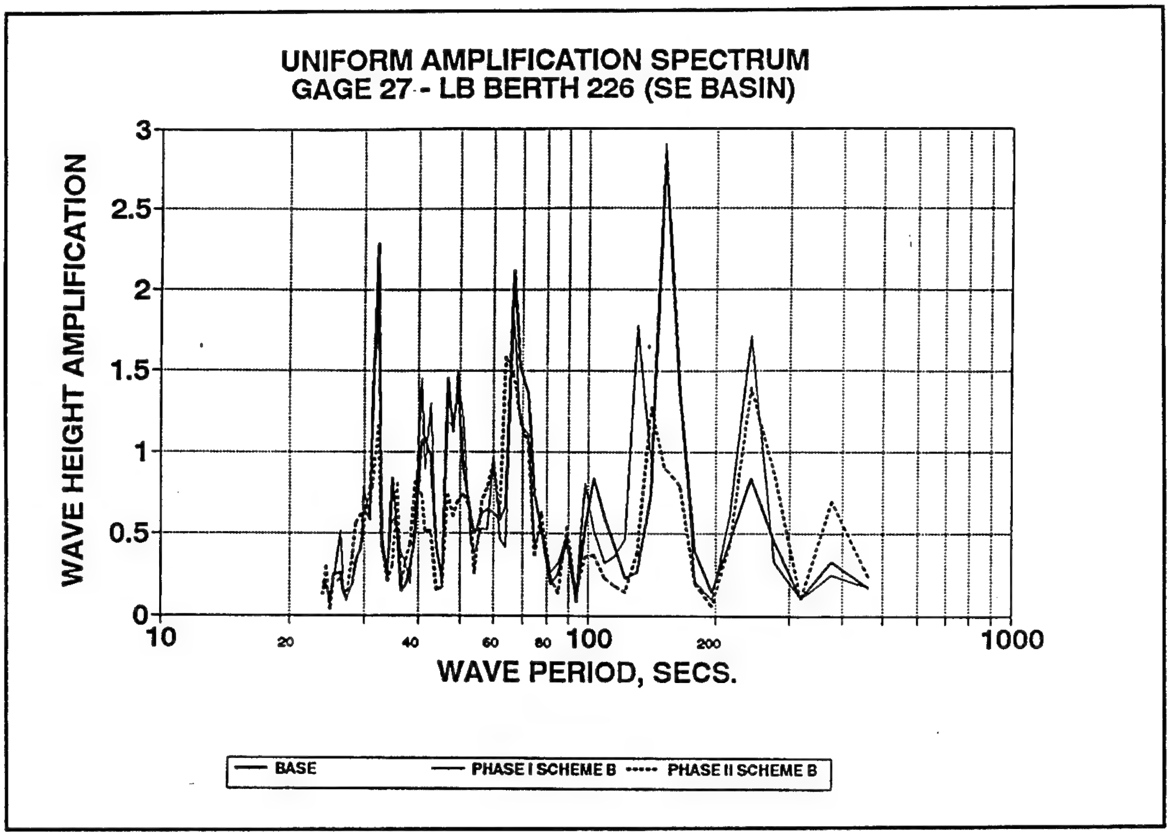

UNIFORM AMPLIFICATION SPECTRUM
GAGE 22 - LB SLIP 2
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

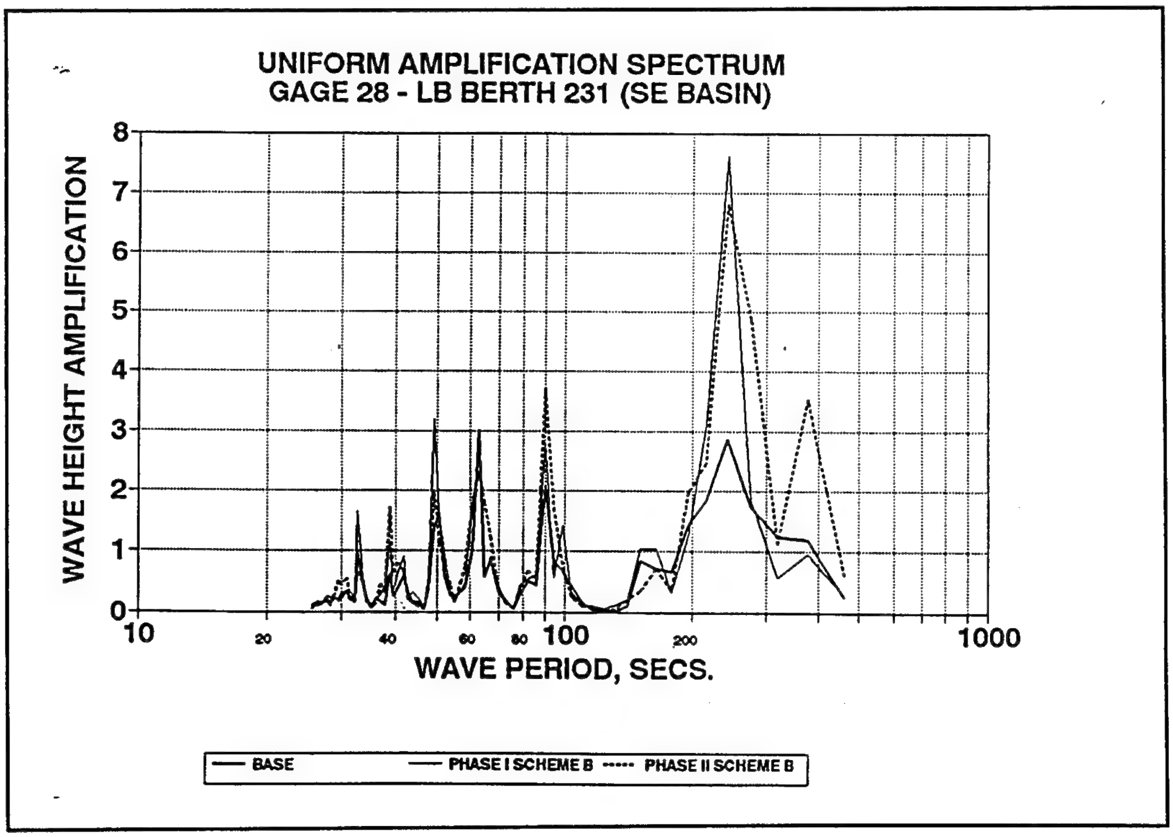

UNIFORM AMPLIFICATION SPECTRUM
GAGE 23 - LB SLIP 1
WAVE HEIGHT AMPLIFICATION
12
10
8
6
4
2
0
10
20
40
60
80
100
200
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

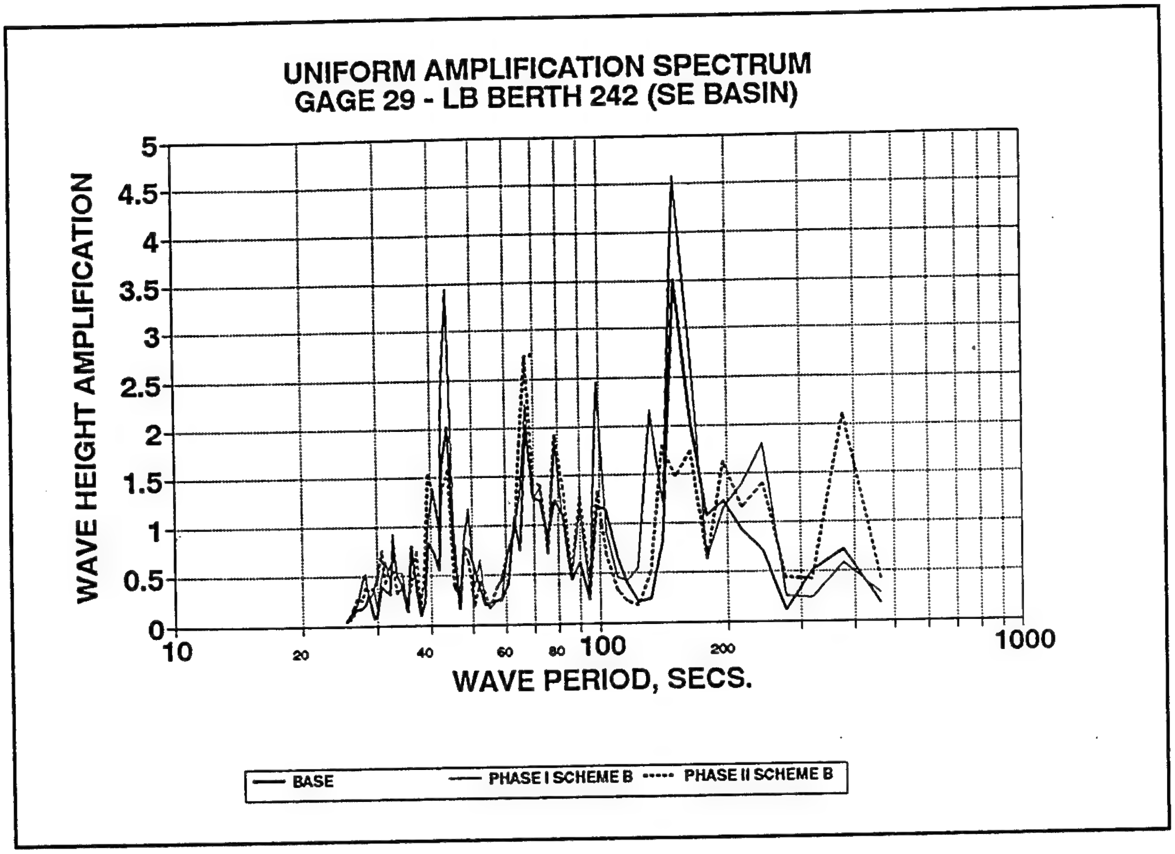

UNIFORM AMPLIFICATION SPECTRUM
GAGE 24 - LB PIER A
WAVE HEIGHT AMPLIFICATION
7
6
5
4
3
2
1
0
10
20
40
60
80
100
200
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

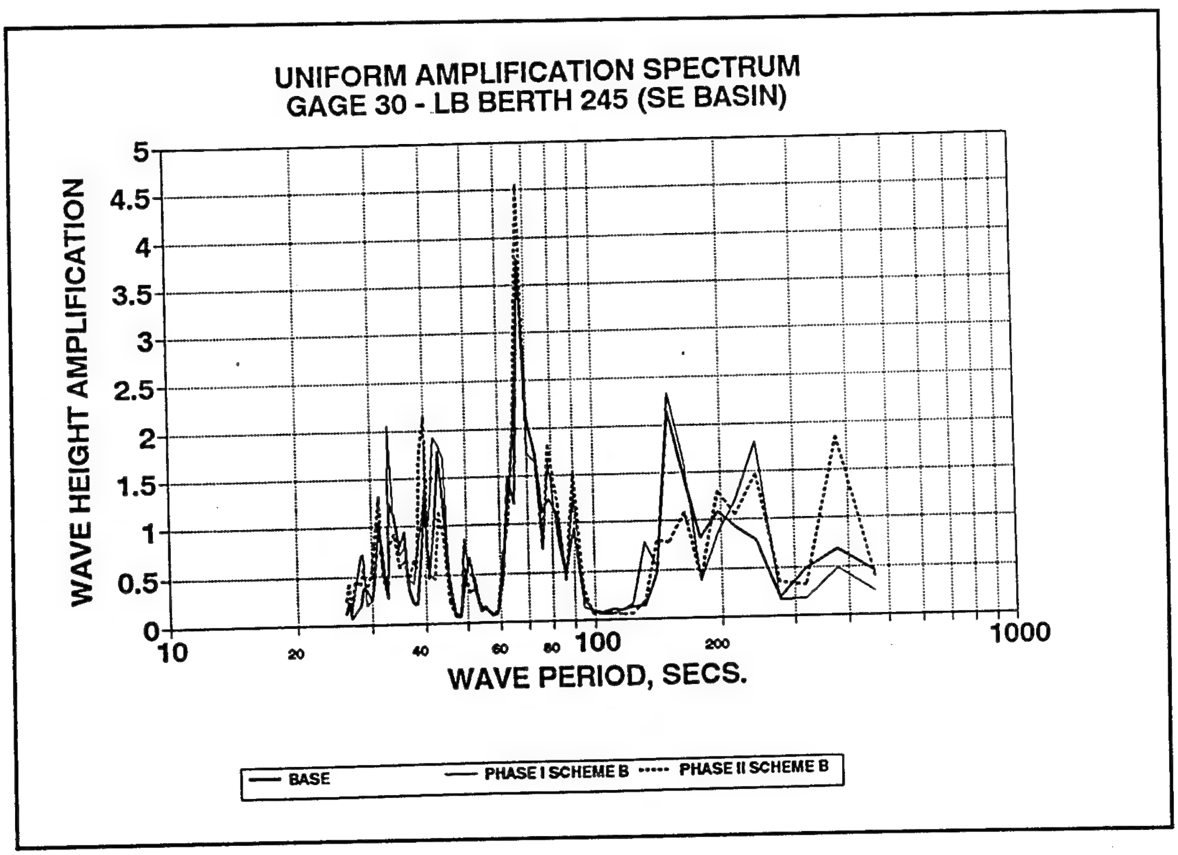

UNIFORM AMPLIFICATION SPECTRUM
GAGE 25 - LB BANANA TERMINAL (BASIN 6)
WAVE HEIGHT AMPLIFICATION
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

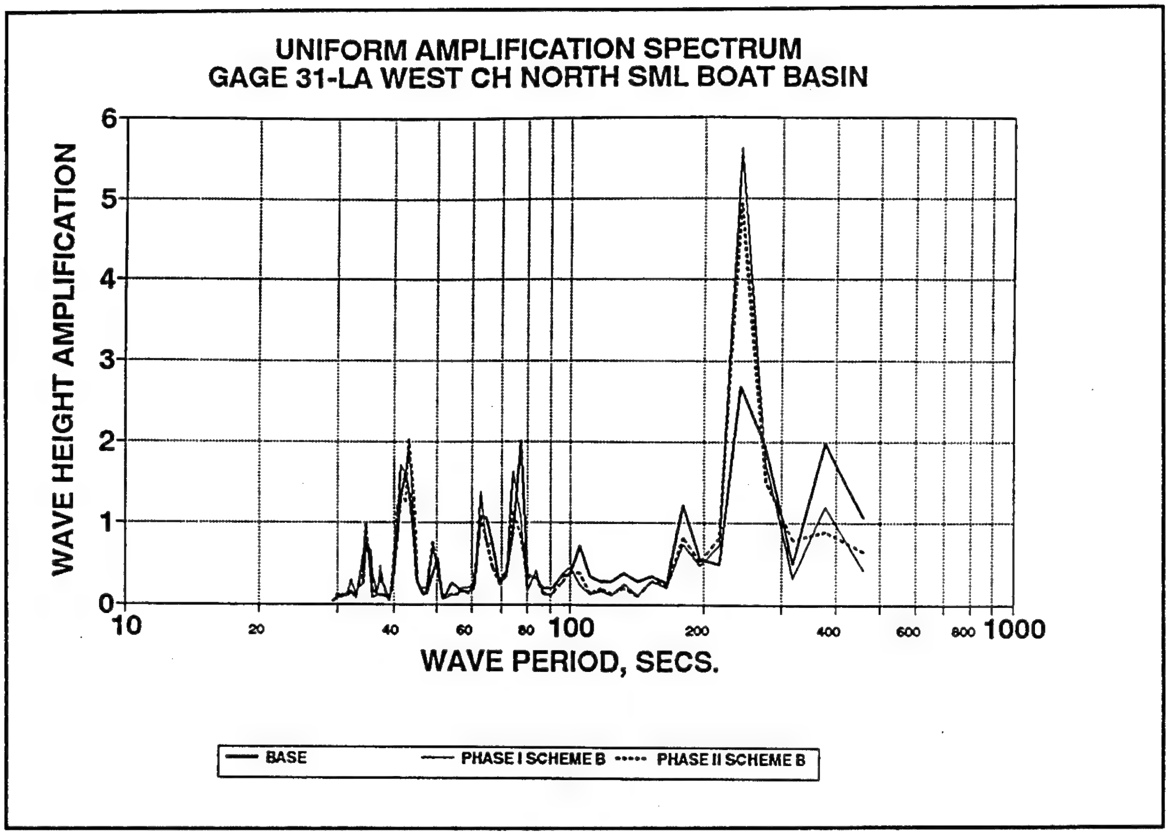

UNIFORM AMPLIFICATION SPECTRUM
GAGE 26 - LB BERTH 205 (BASIN 6)
WAVE HEIGHT AMPLIFICATION
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

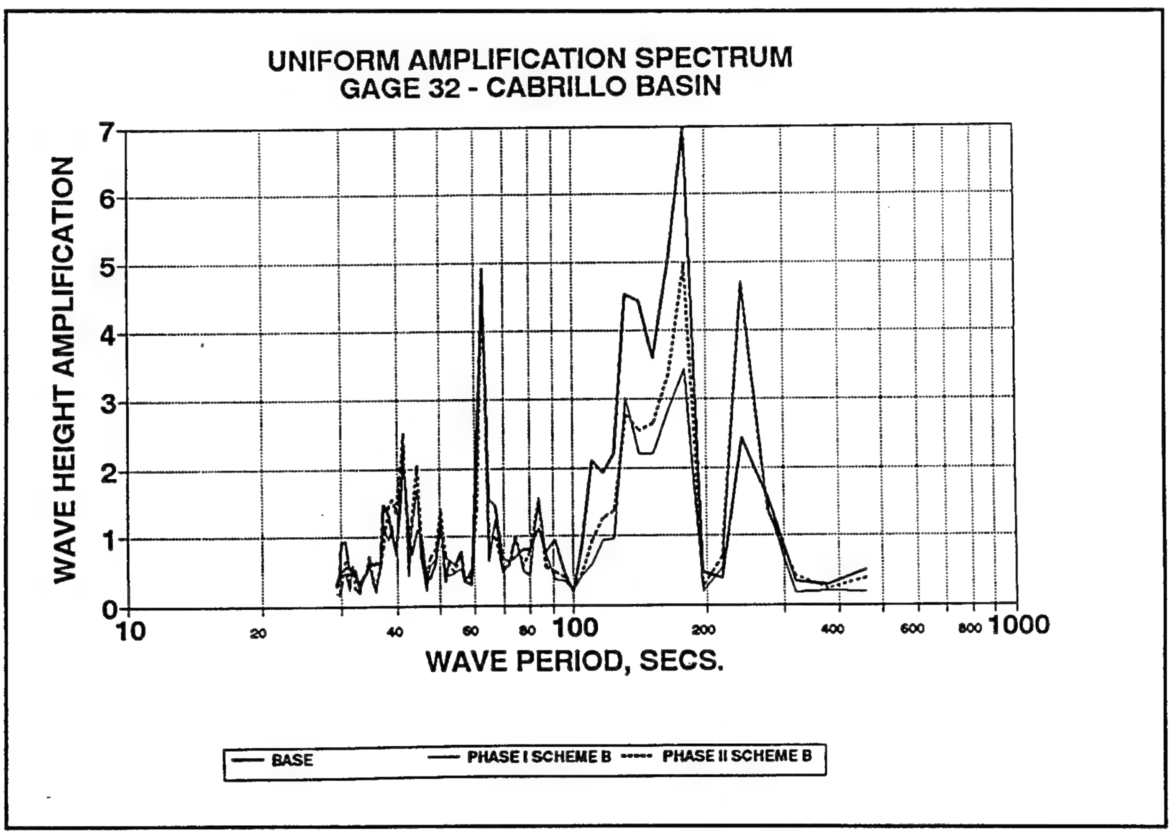

UNIFORM AMPLIFICATION SPECTRUM
GAGE 27 - LB BERTH 226 (SE BASIN)
WAVE HEIGHT AMPLIFICATION
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

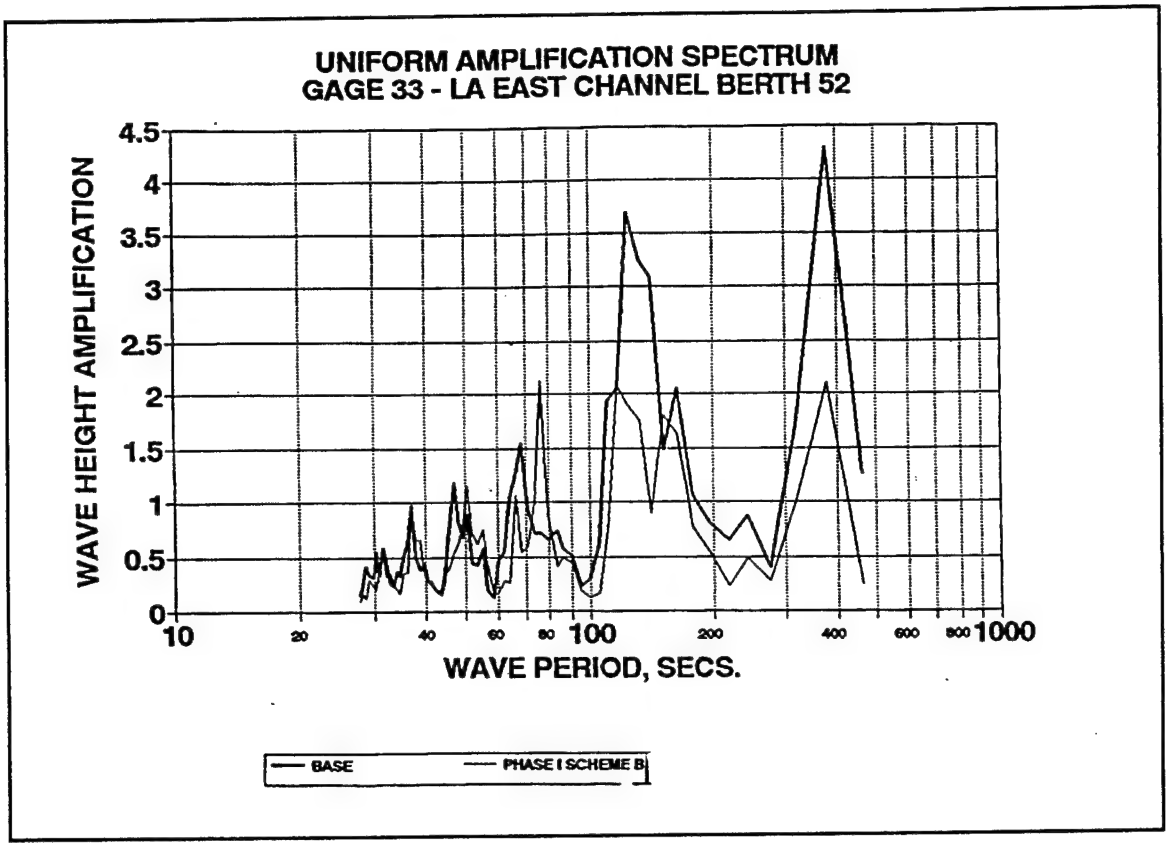

UNIFORM AMPLIFICATION SPECTRUM
GAGE 28 - LB BERTH 231 (SE BASIN)
WAVE HEIGHT AMPLIFICATION
8
7
6
5
4
3
2
1
0
10
20
40
60
80
100
200
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

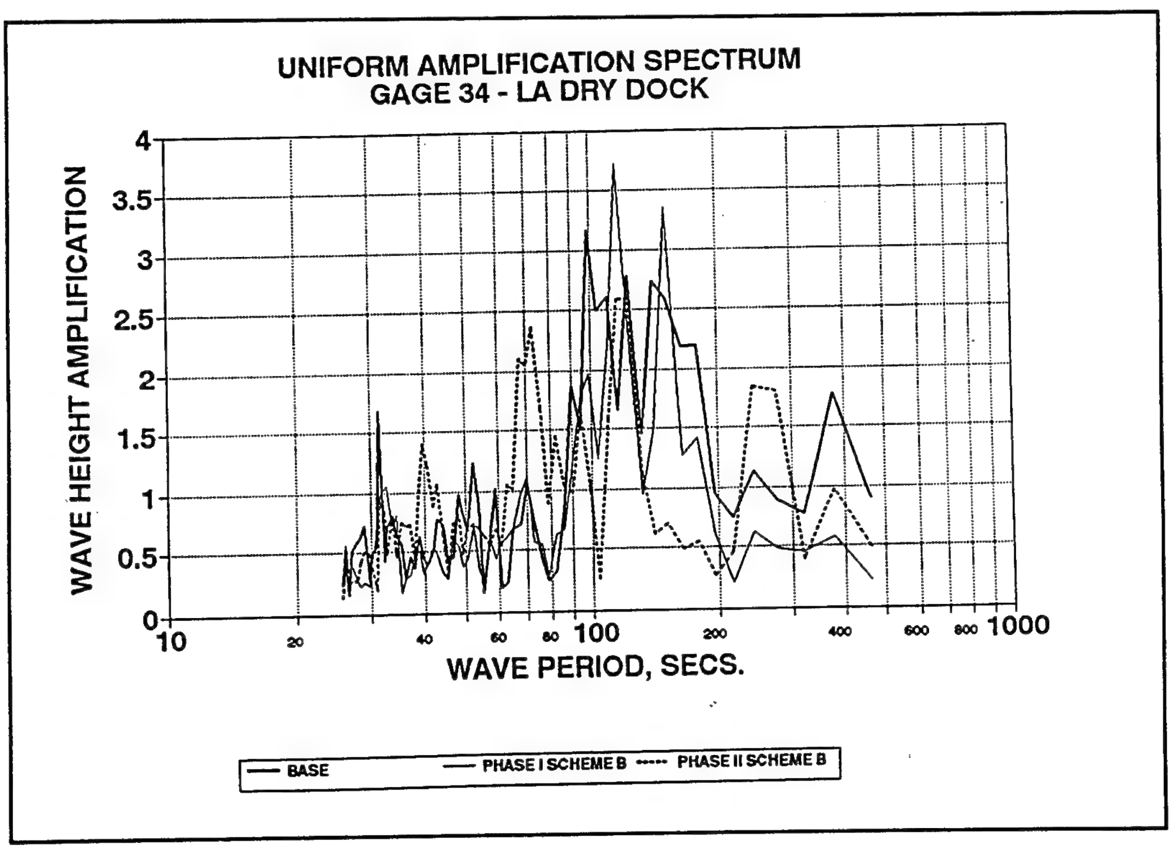

UNIFORM AMPLIFICATION SPECTRUM
GAGE 29 - LB BERTH 242 (SE BASIN)
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
10
20
40
60
80
100
200
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

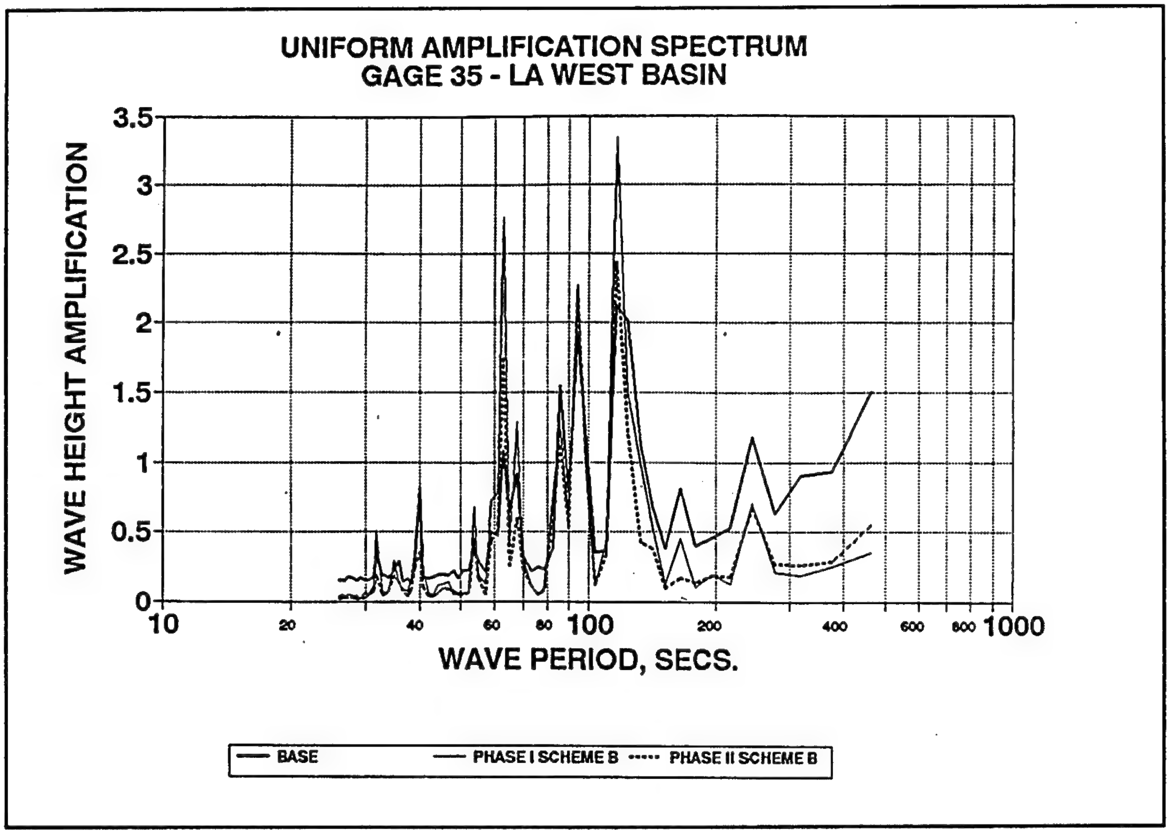

UNIFORM AMPLIFICATION SPECTRUM
GAGE 30 - LB BERTH 245 (SE BASIN)
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
10
20
40
60
80
100
200
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

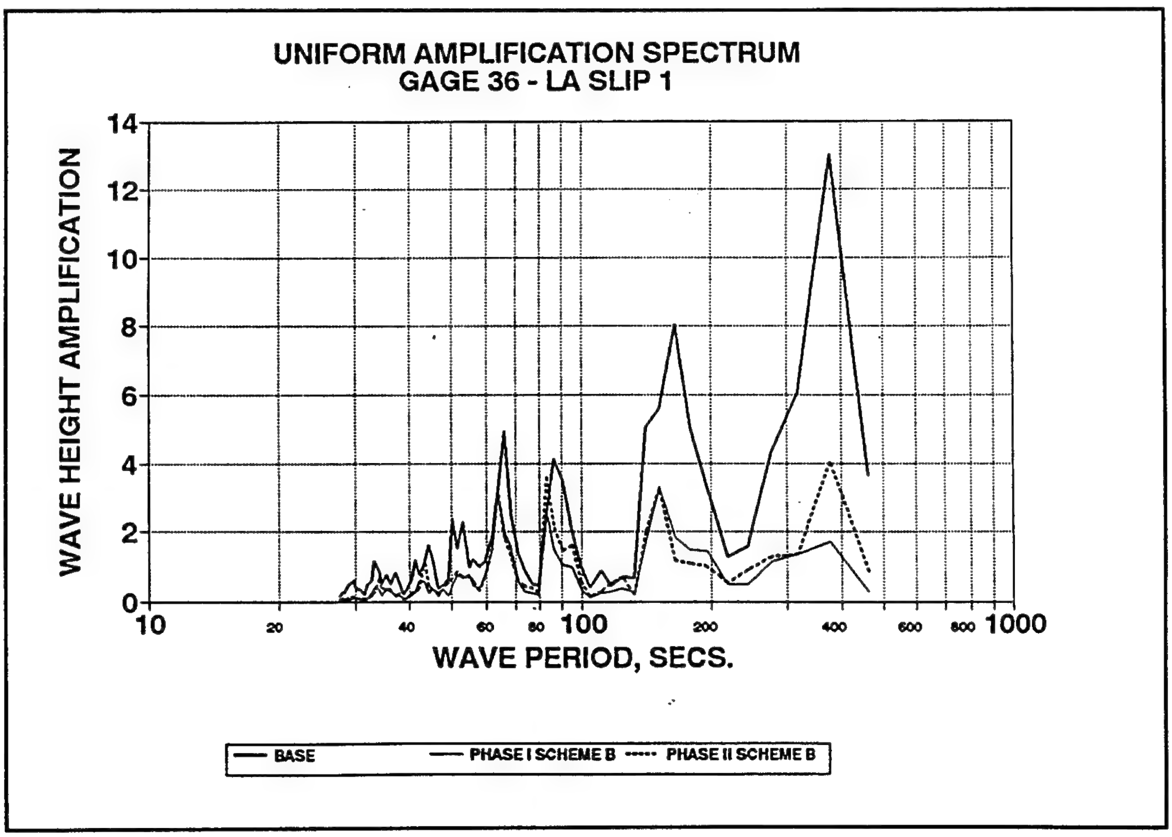

UNIFORM AMPLIFICATION SPECTRUM
GAGE 31-LA WEST CH NORTH SML BOAT BASIN
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

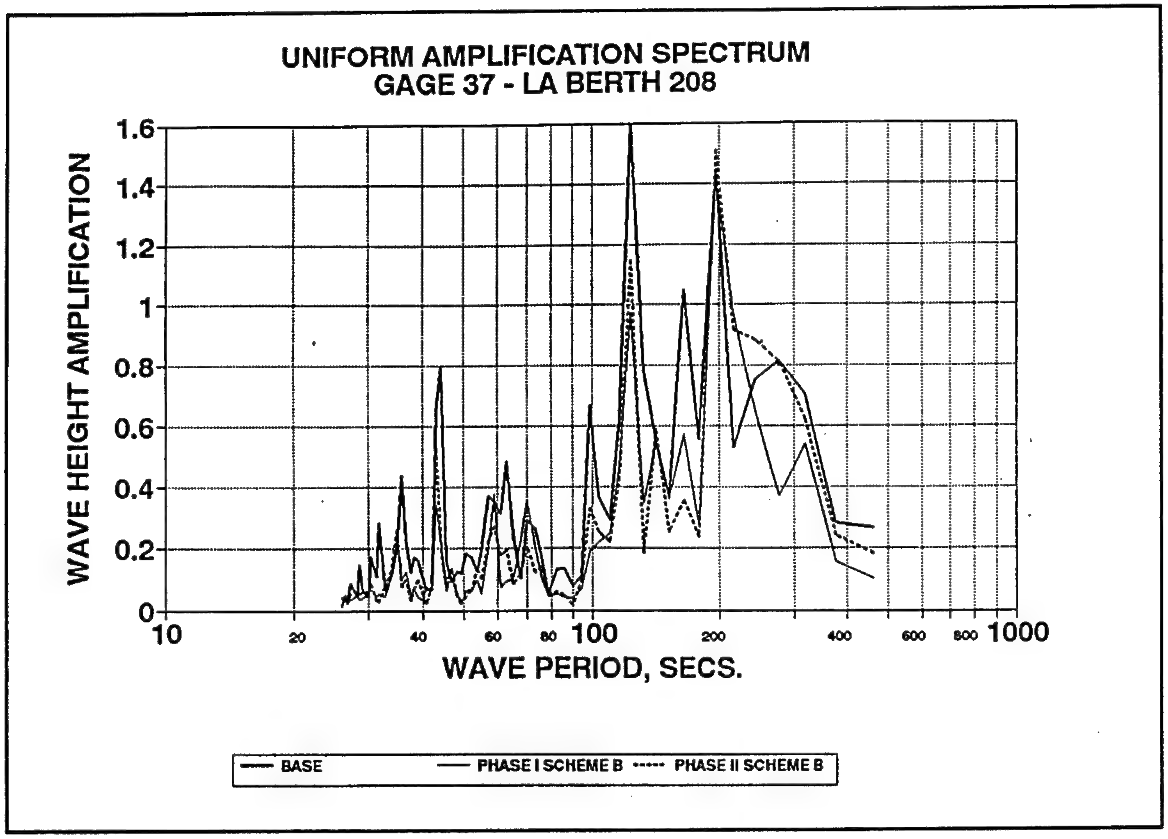

UNIFORM AMPLIFICATION SPECTRUM
GAGE 32 - CABRILLO BASIN
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
7
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

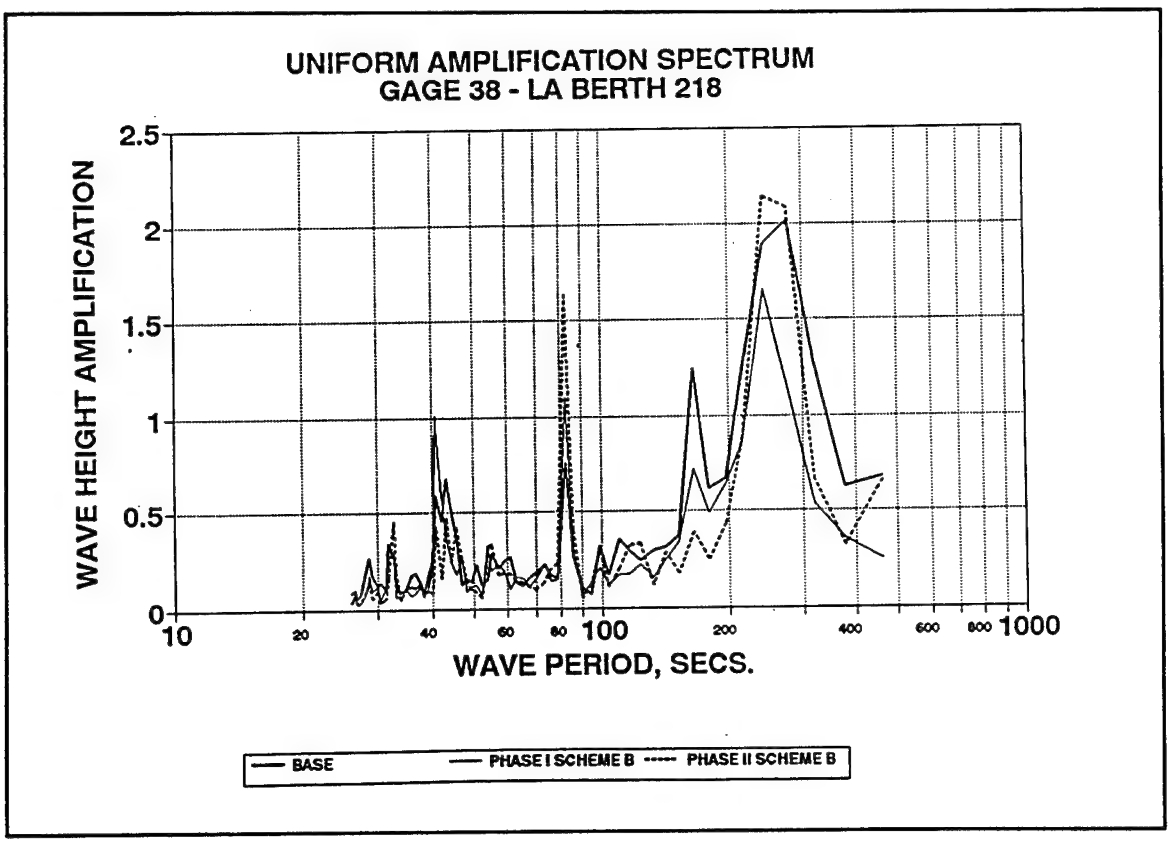

UNIFORM AMPLIFICATION SPECTRUM
GAGE 33 - LA EAST CHANNEL BERTH 52
WAVE HEIGHT AMPLIFICATION
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B

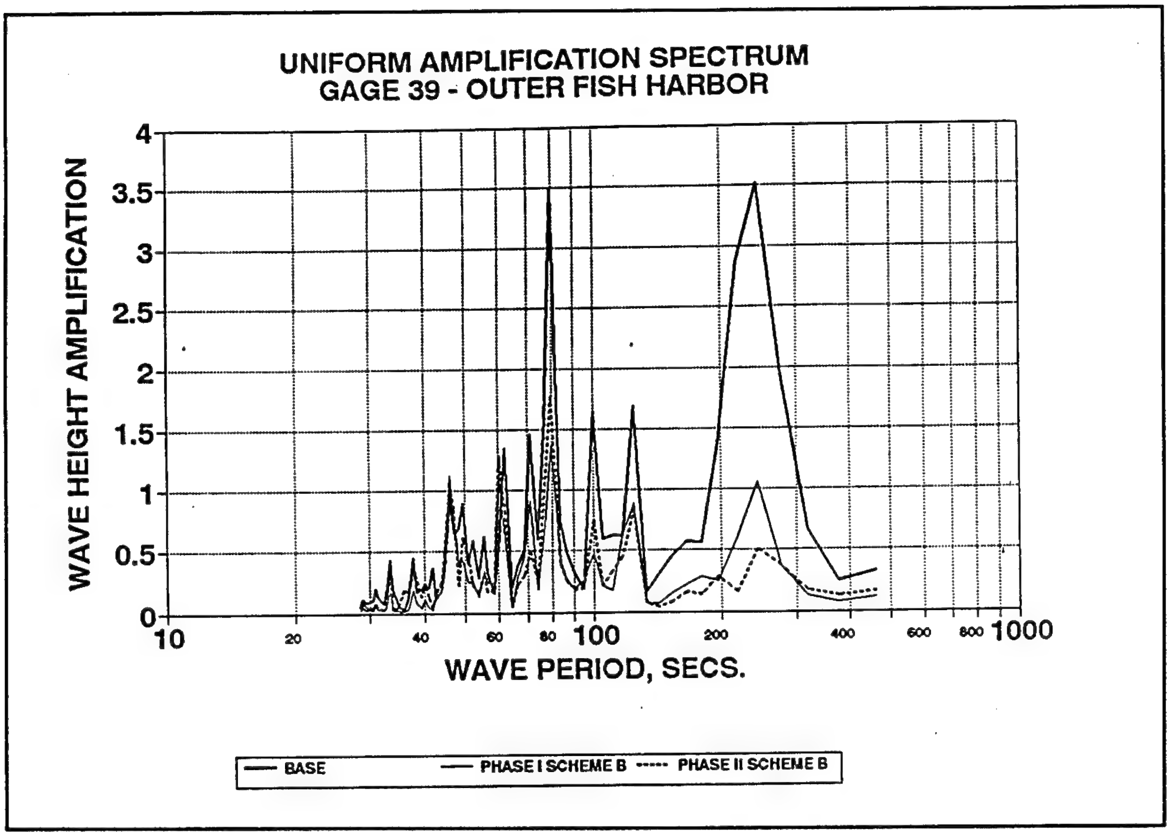

UNIFORM AMPLIFICATION SPECTRUM
GAGE 34 - LA DRY DOCK
WAVE HEIGHT AMPLIFICATION
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

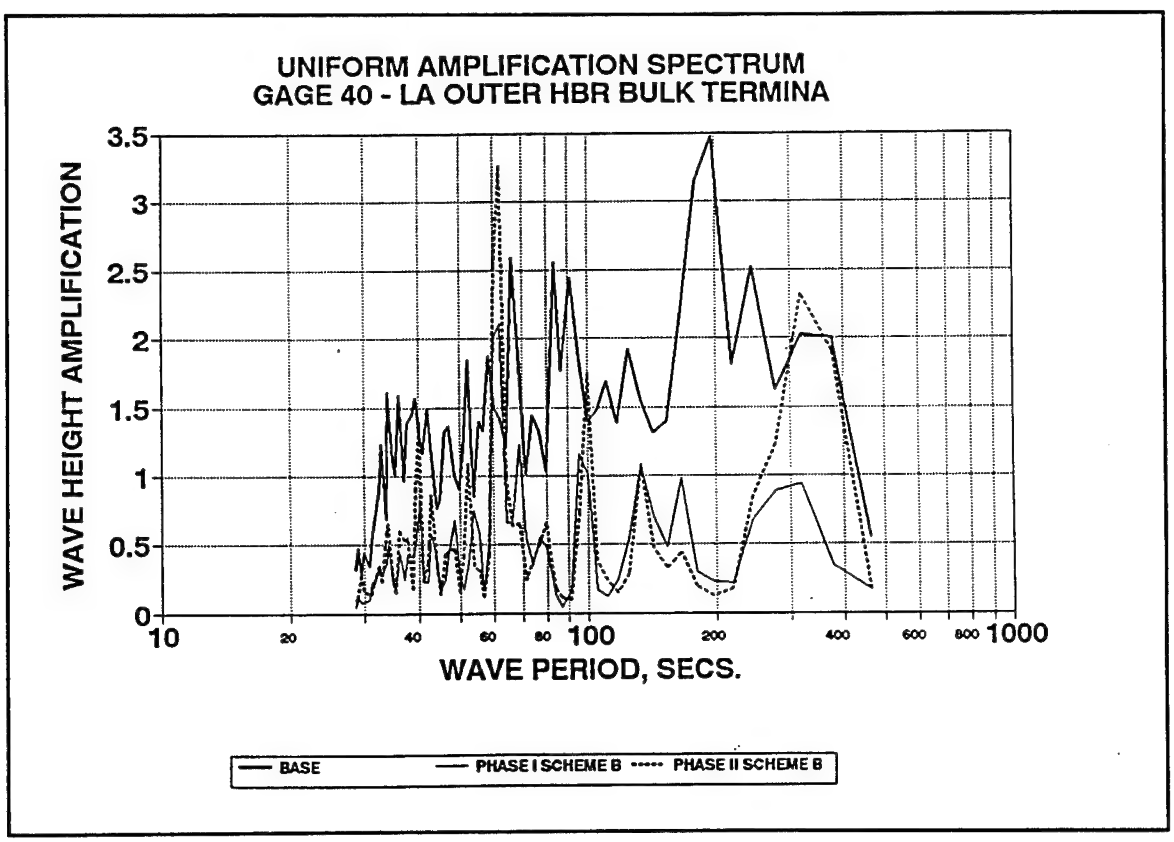

UNIFORM AMPLIFICATION SPECTRUM
GAGE 35 - LA WEST BASIN
WAVE HEIGHT AMPLIFICATION
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

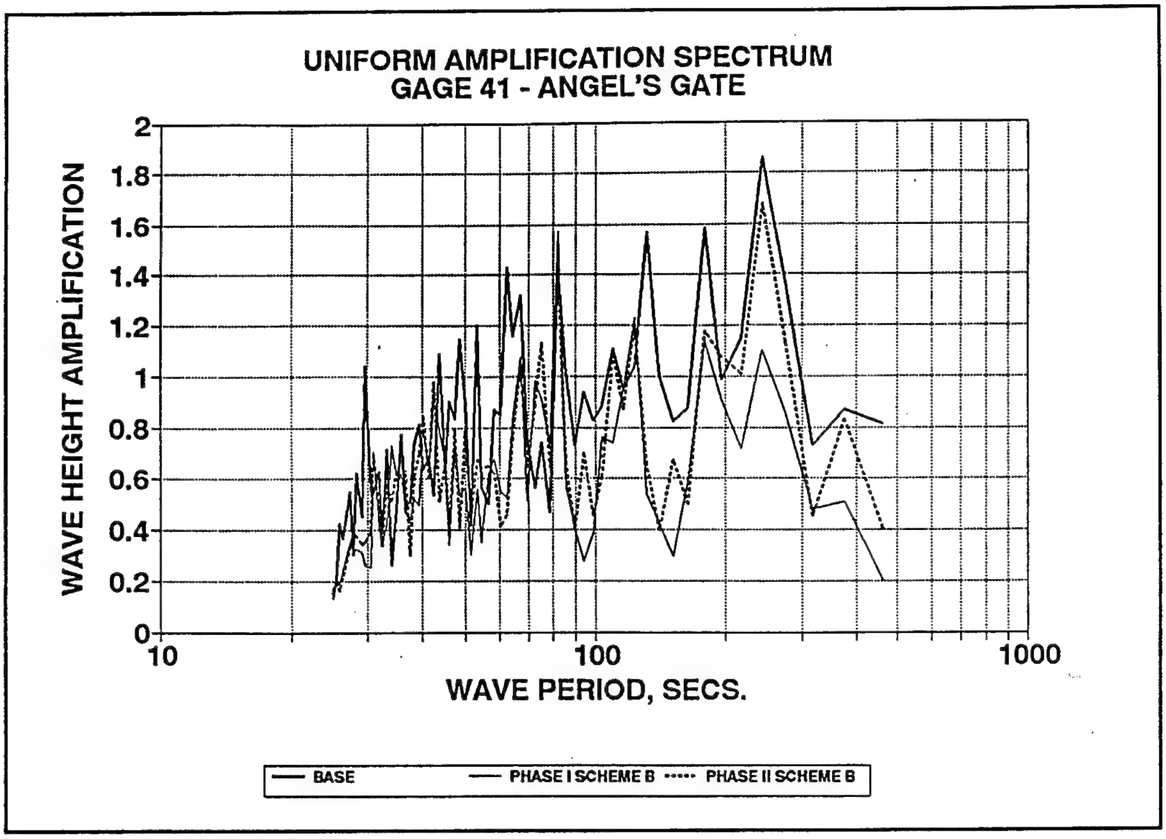

UNIFORM AMPLIFICATION SPECTRUM
GAGE 36 - LA SLIP 1
WAVE HEIGHT AMPLIFICATION
14
12
10
8
6
4
2
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

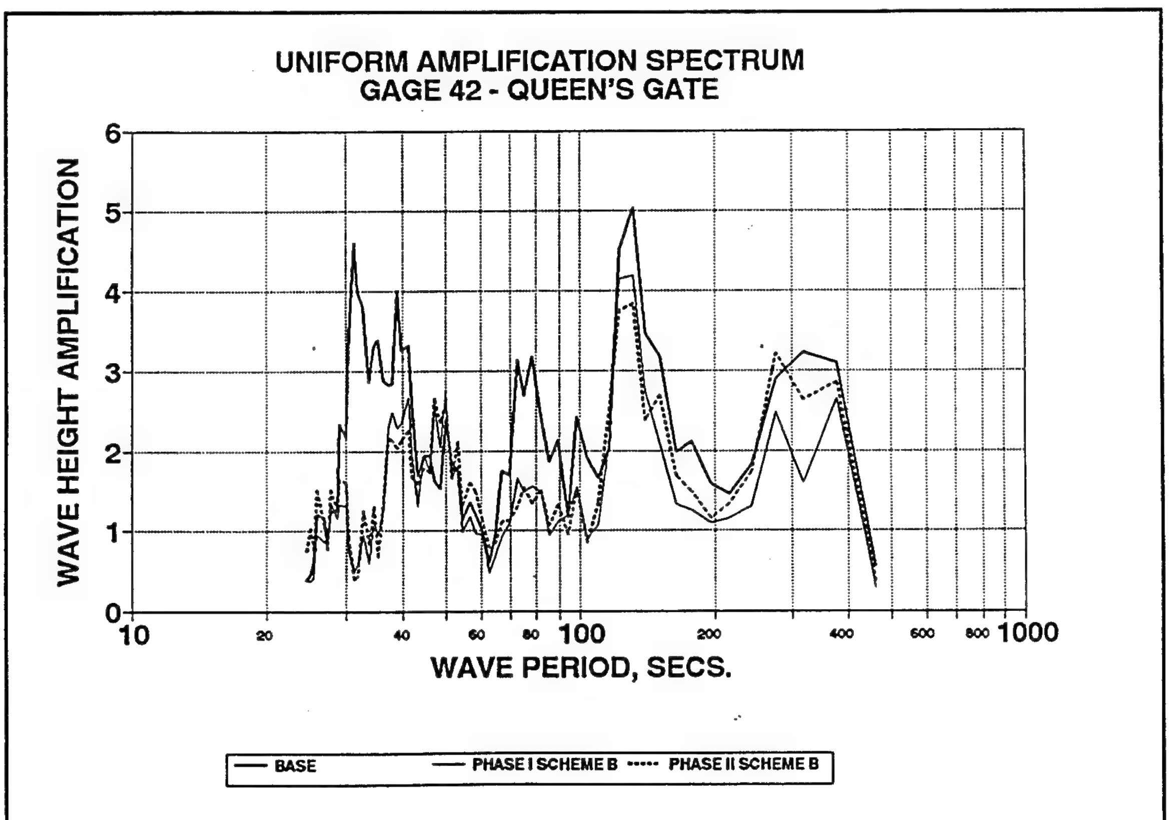

UNIFORM AMPLIFICATION SPECTRUM
GAGE 37 - LA BERTH 208
WAVE HEIGHT AMPLIFICATION
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

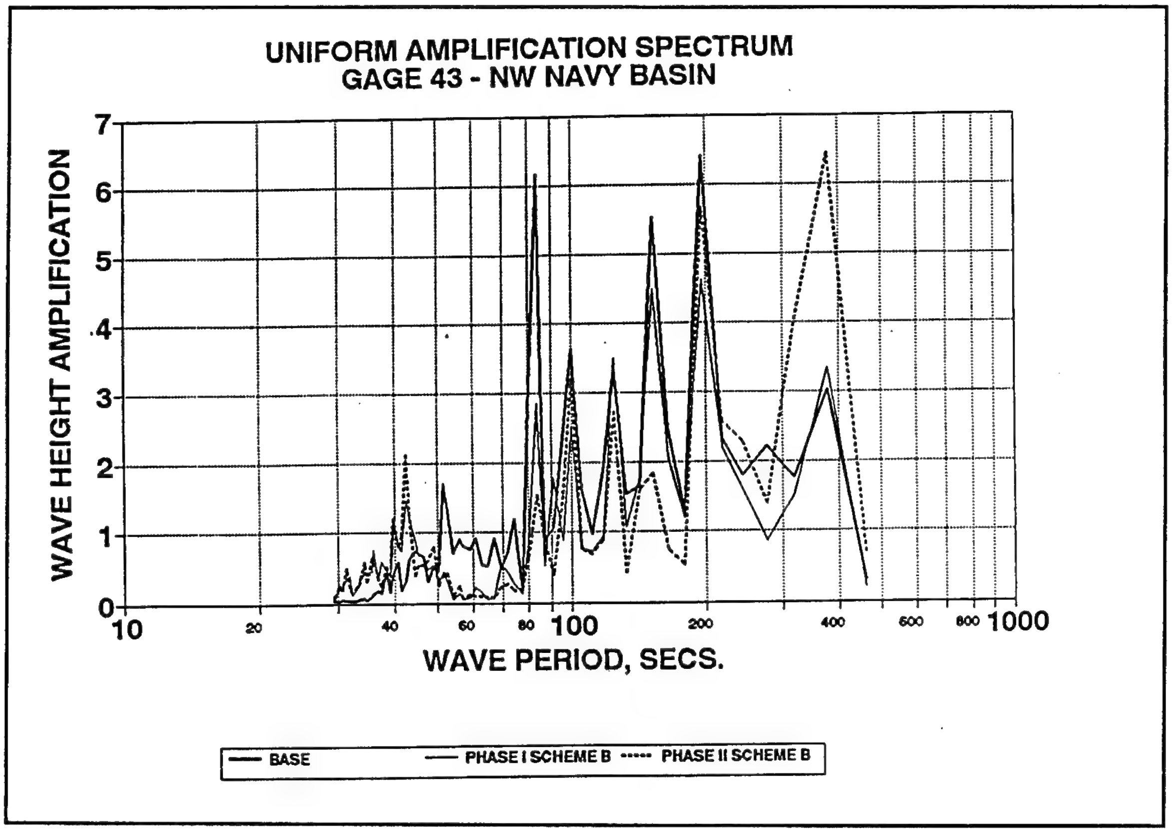

UNIFORM AMPLIFICATION SPECTRUM
GAGE 38 - LA BERTH 218
WAVE HEIGHT AMPLIFICATION
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B


UNIFORM AMPLIFICATION SPECTRUM
GAGE 39 - OUTER FISH HARBOR
WAVE HEIGHT AMPLIFICATION
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

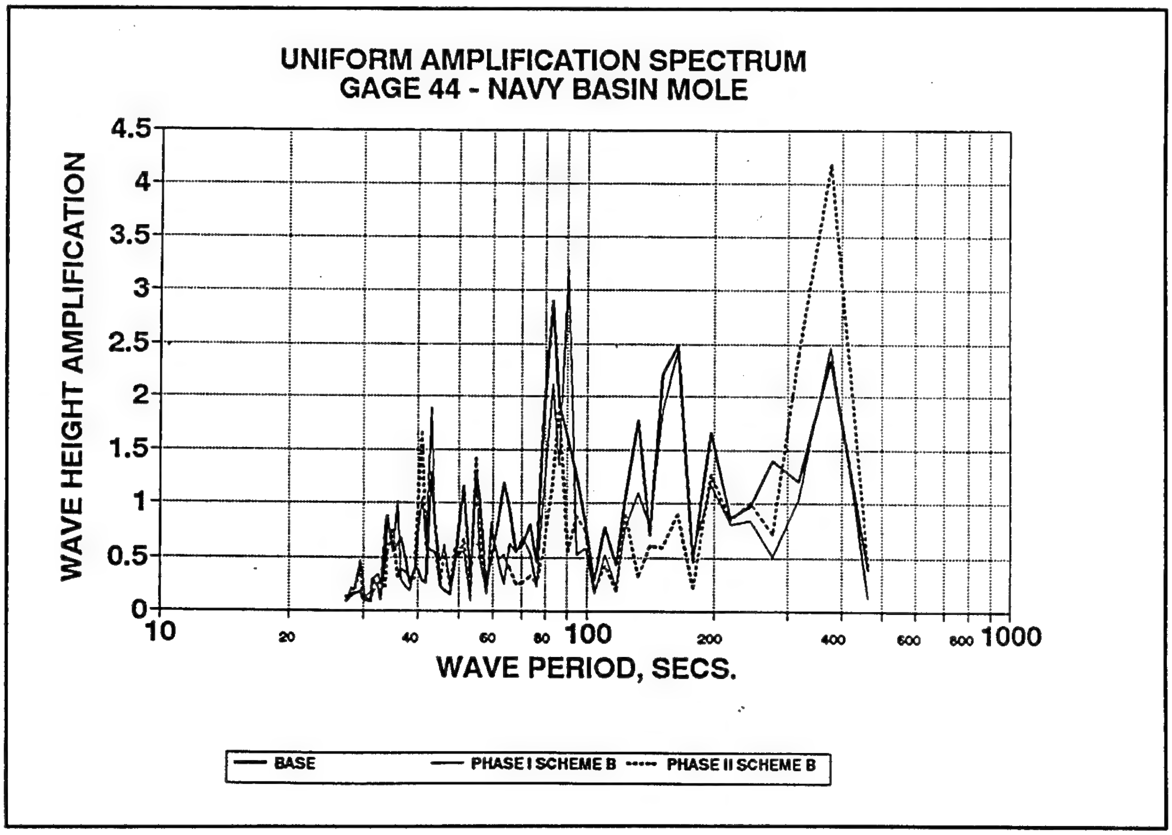

UNIFORM AMPLIFICATION SPECTRUM
GAGE 40 - LA OUTER HBR BULK TERMINA
WAVE HEIGHT AMPLIFICATION
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B


UNIFORM AMPLIFICATION SPECTRUM
GAGE 41 - ANGEL'S GATE
WAVE HEIGHT AMPLIFICATION
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
10
100
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

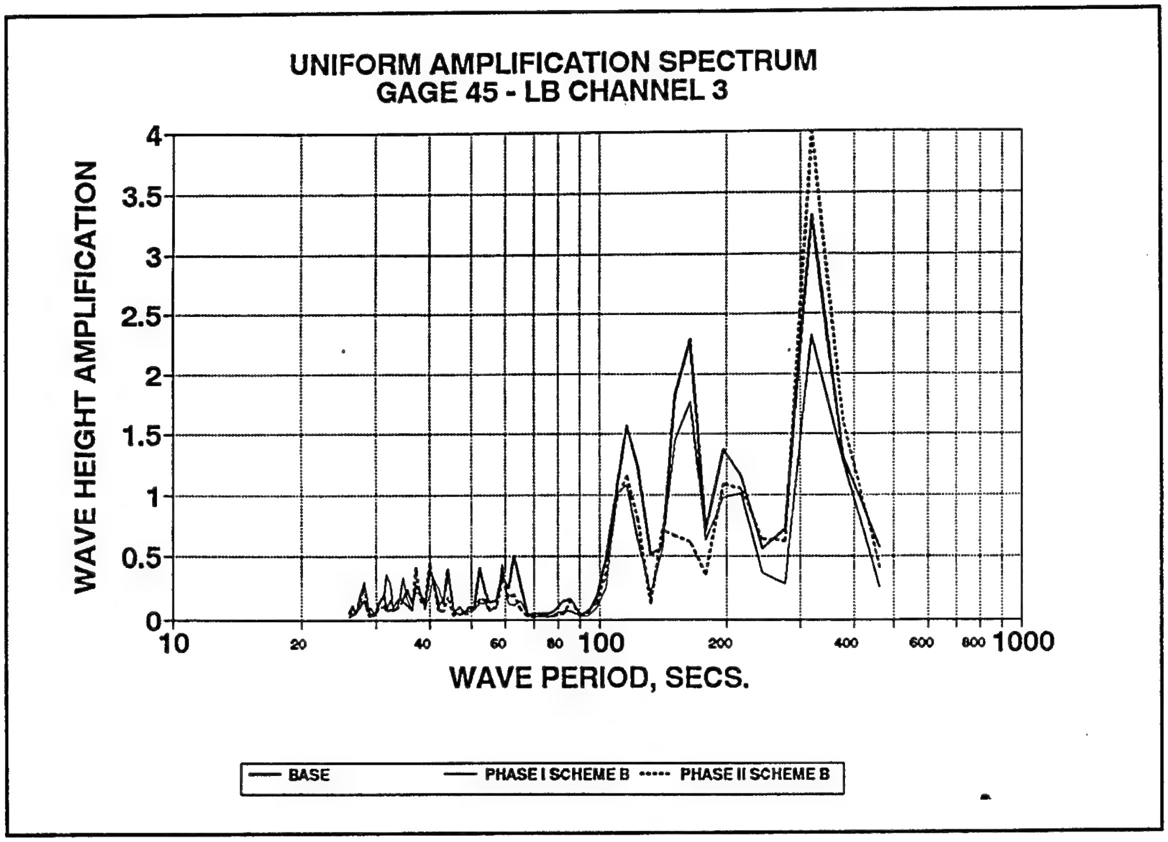

UNIFORM AMPLIFICATION SPECTRUM
GAGE 42 - QUEEN'S GATE
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

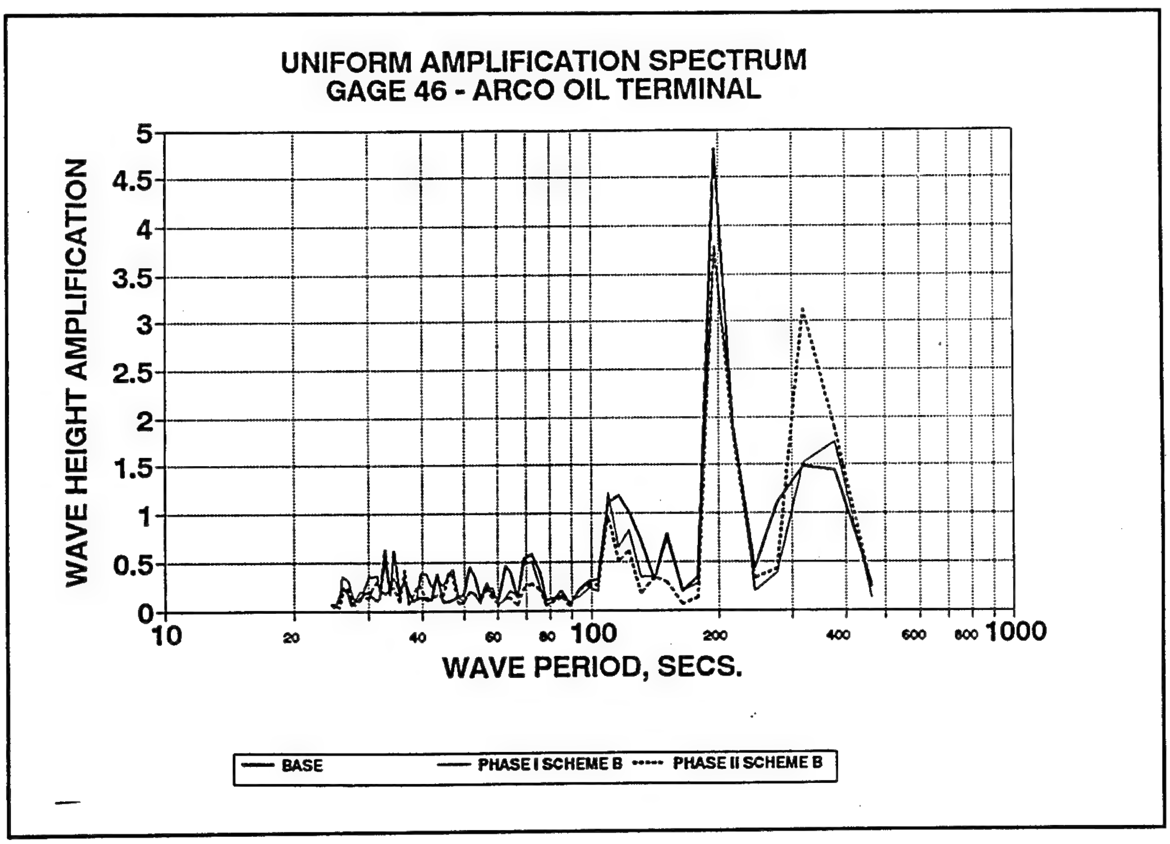


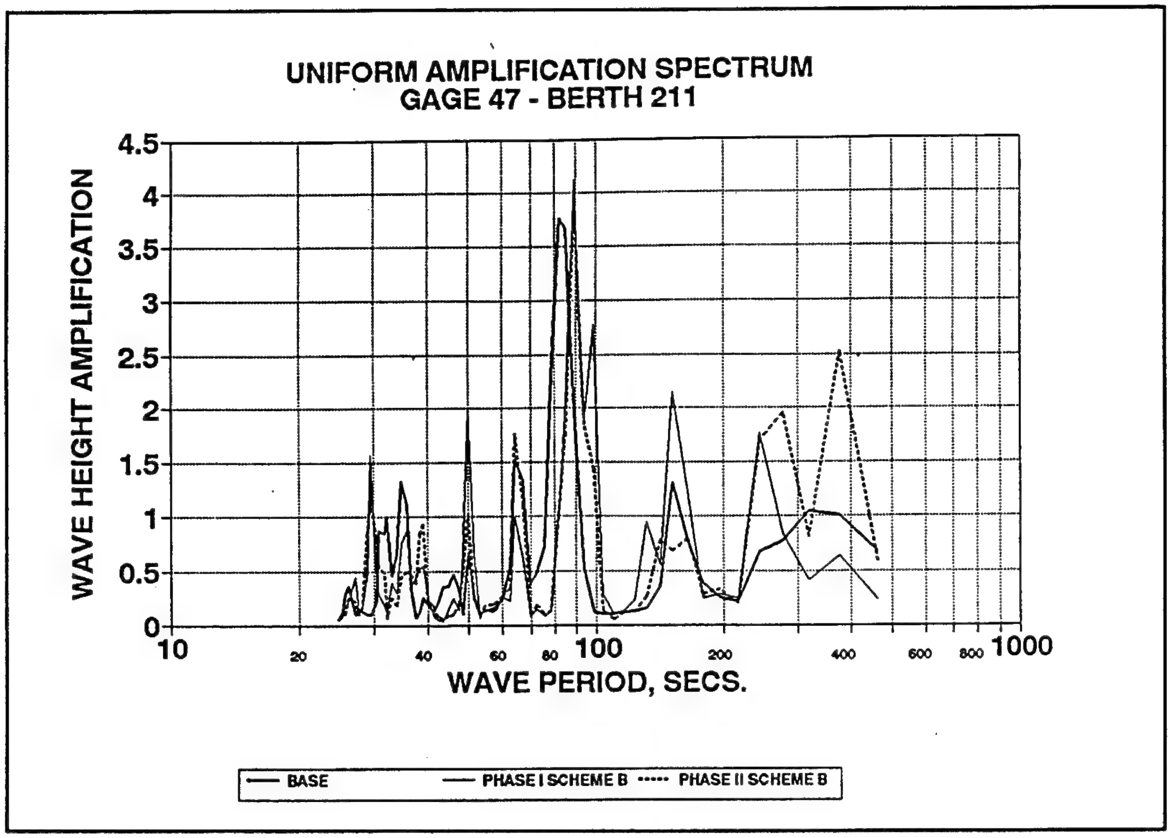
UNIFORM AMPLIFICATION SPECTRUM
GAGE 43 - NW NAVY BASIN
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
7
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

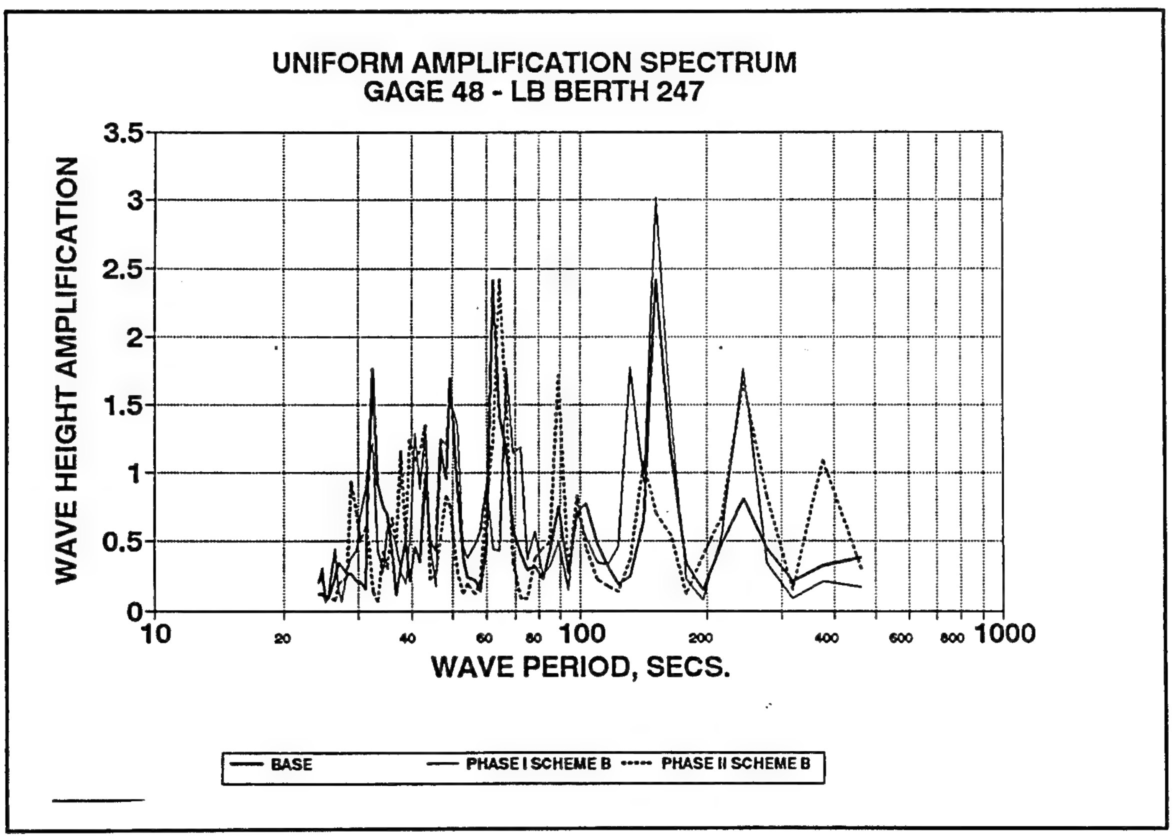



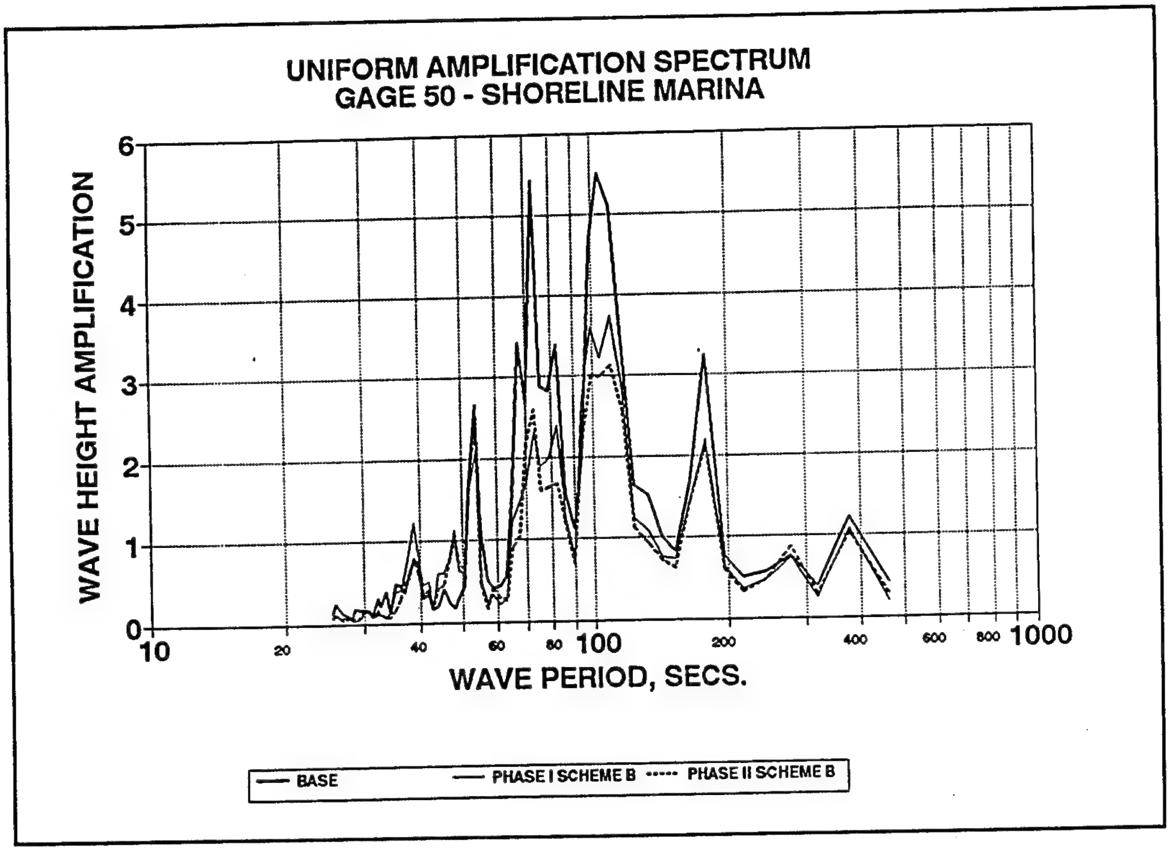
UNIFORM AMPLIFICATION SPECTRUM
GAGE 44 - NAVY BASIN MOLE
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

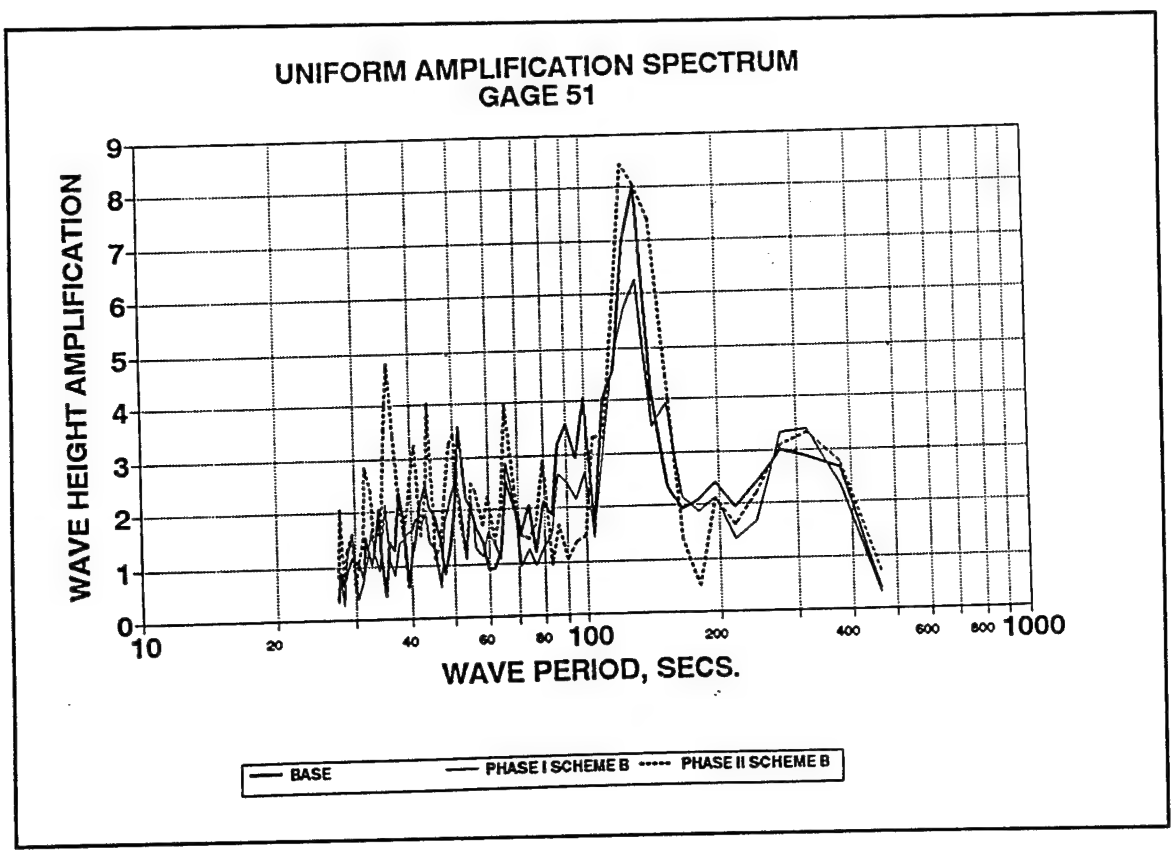

UNIFORM AMPLIFICATION SPECTRUM
GAGE 45 - LB CHANNEL 3
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
4
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

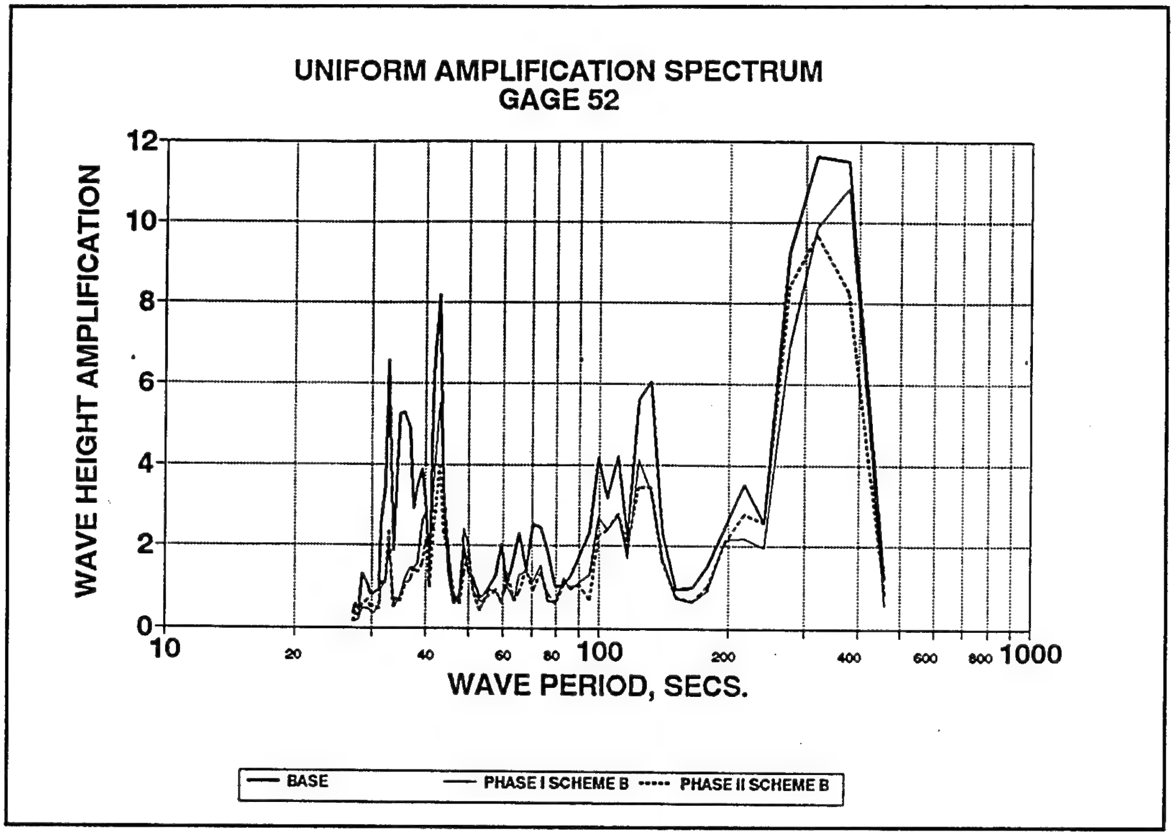

UNIFORM AMPLIFICATION SPECTRUM
GAGE 46 - ARCO OIL TERMINAL
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

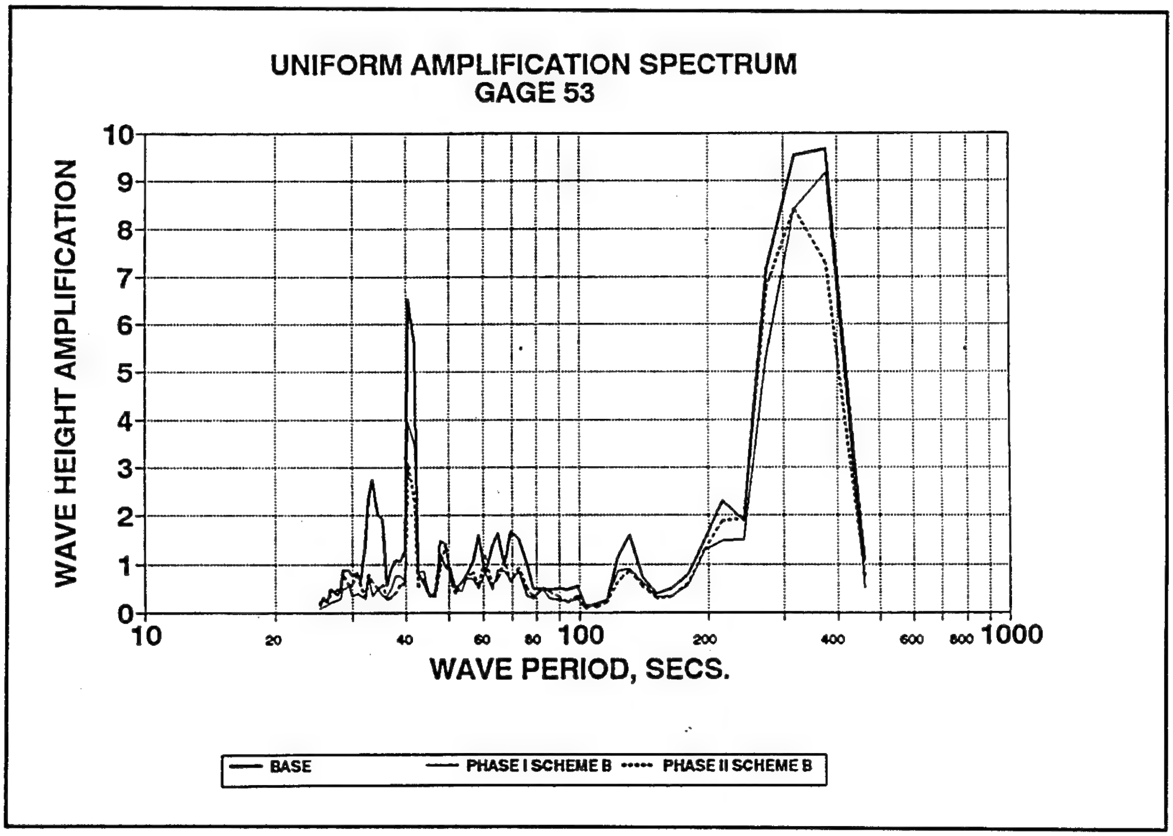

UNIFORM AMPLIFICATION SPECTRUM
GAGE 47 - BERTH 211
WAVE HEIGHT AMPLIFICATION
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

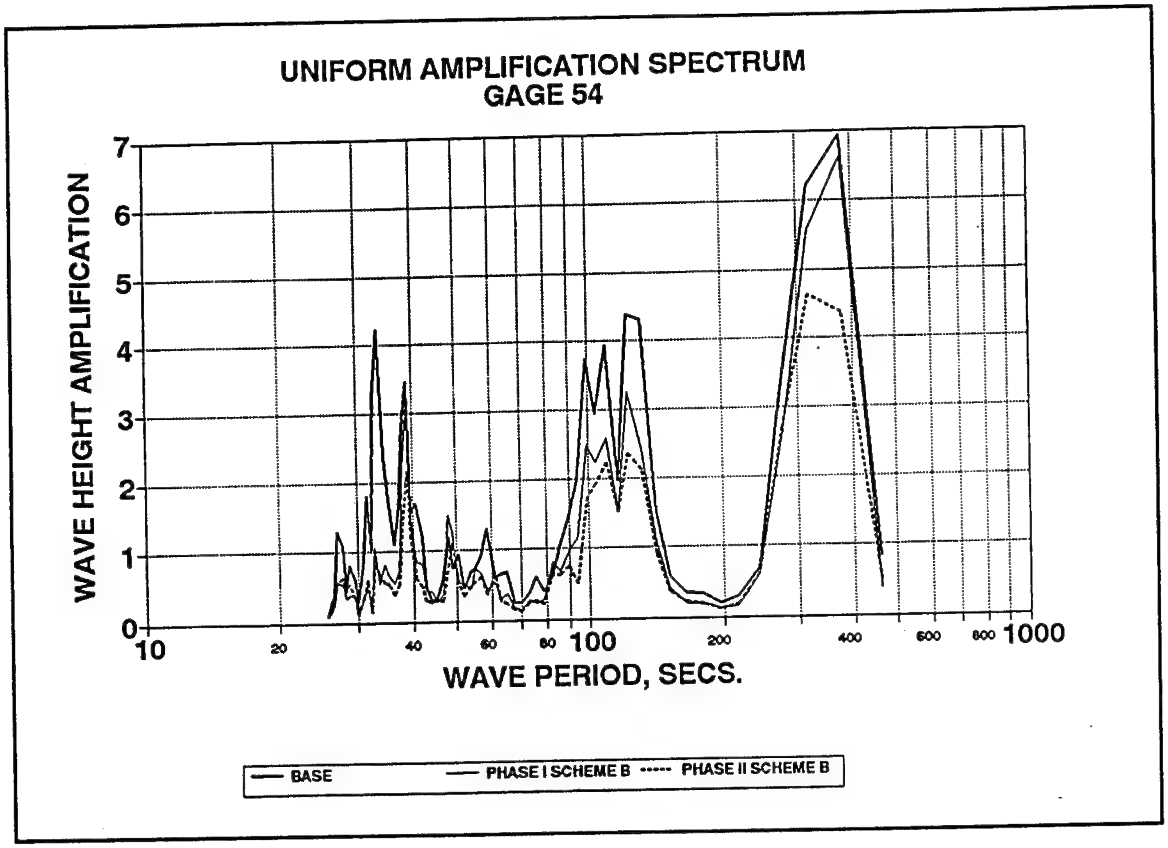

UNIFORM AMPLIFICATION SPECTRUM
GAGE 48 - LB BERTH 247
WAVE HEIGHT AMPLIFICATION
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

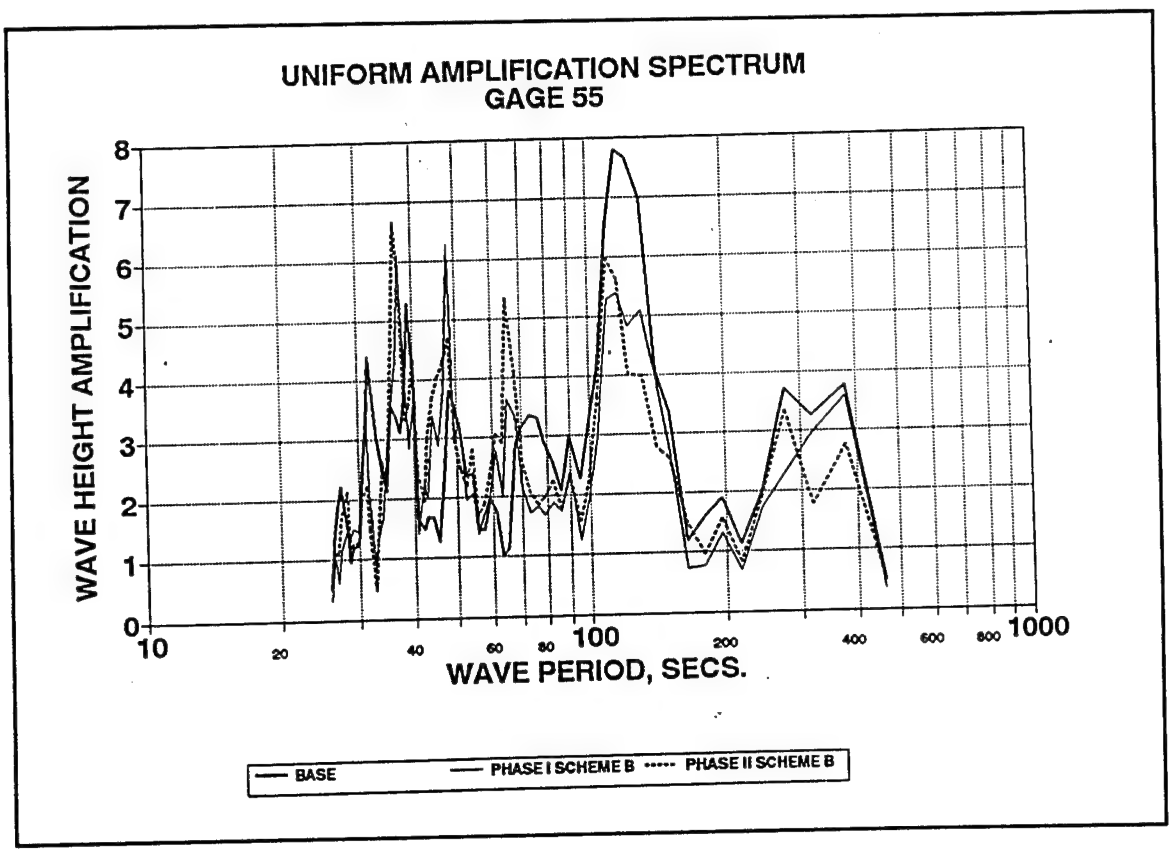

UNIFORM AMPLIFICATION SPECTRUM
GAGE 50 - SHORELINE MARINA
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

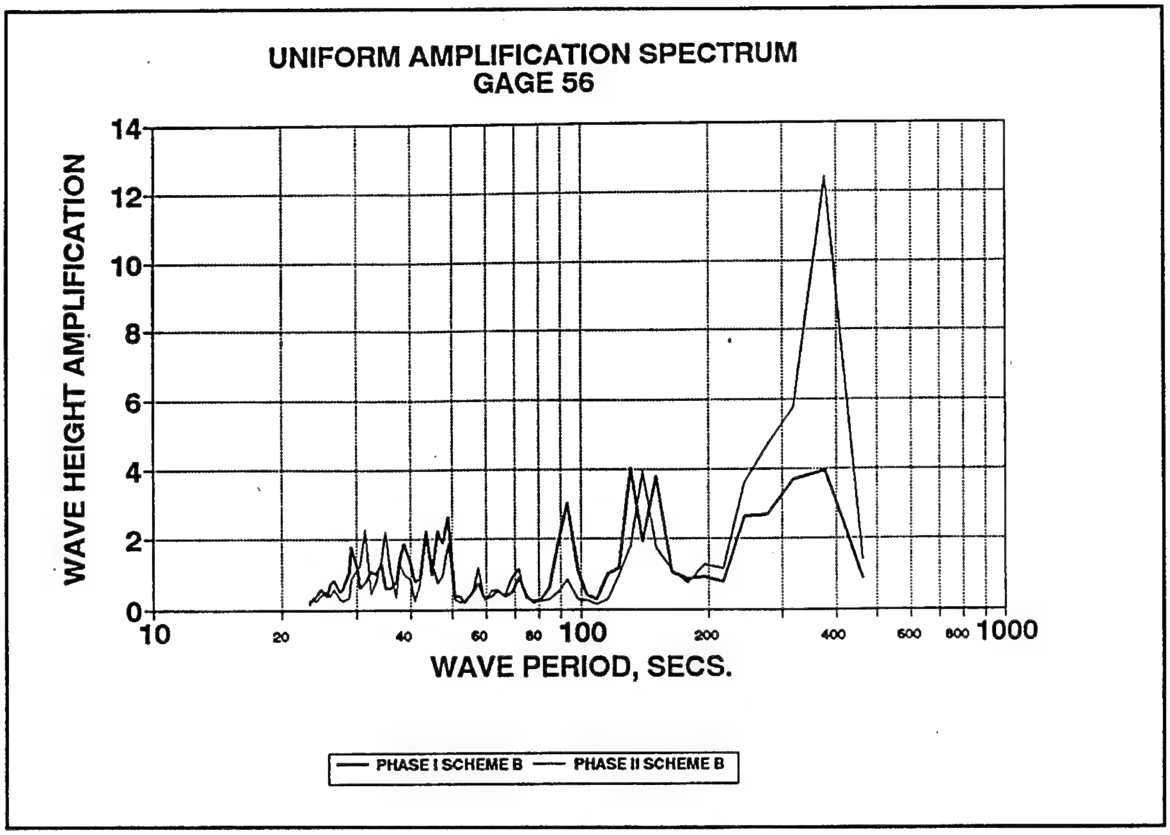

UNIFORM AMPLIFICATION SPECTRUM
GAGE 51
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
7
8
9
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

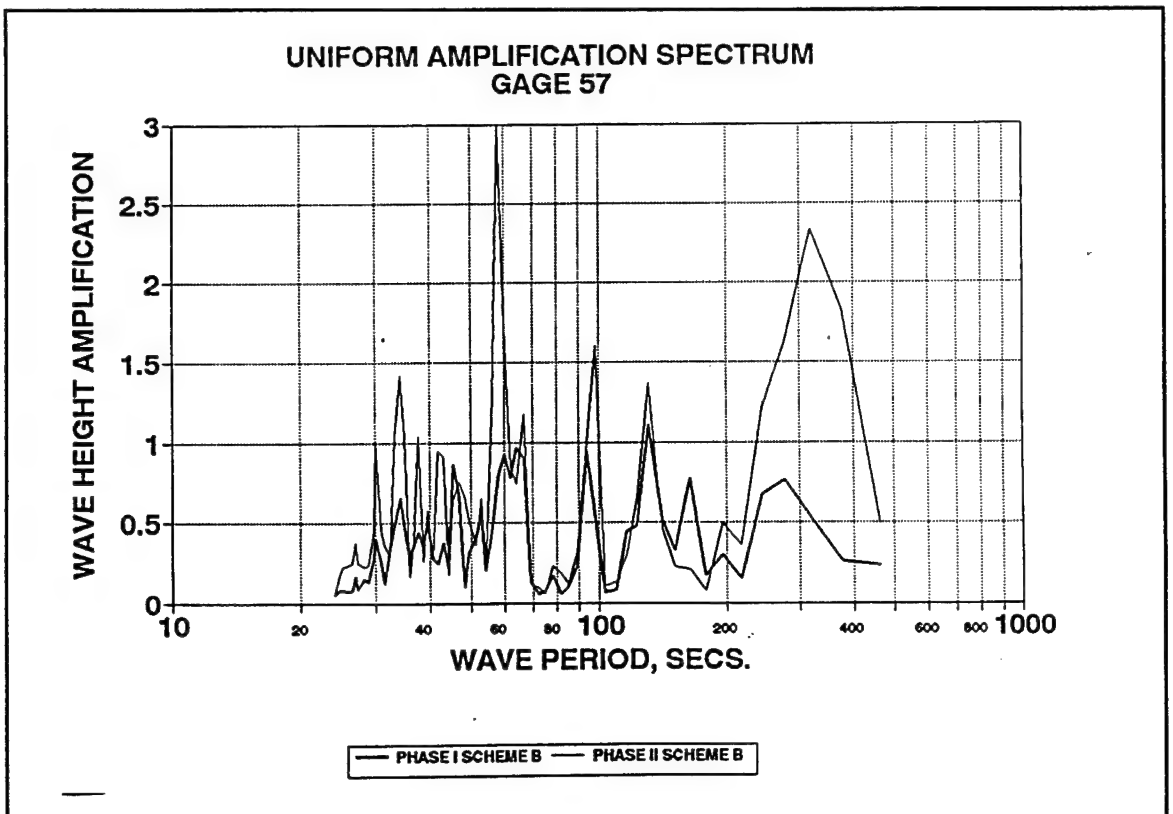

UNIFORM AMPLIFICATION SPECTRUM
GAGE 52
WAVE HEIGHT AMPLIFICATION
0
2
4
6
8
10
12
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

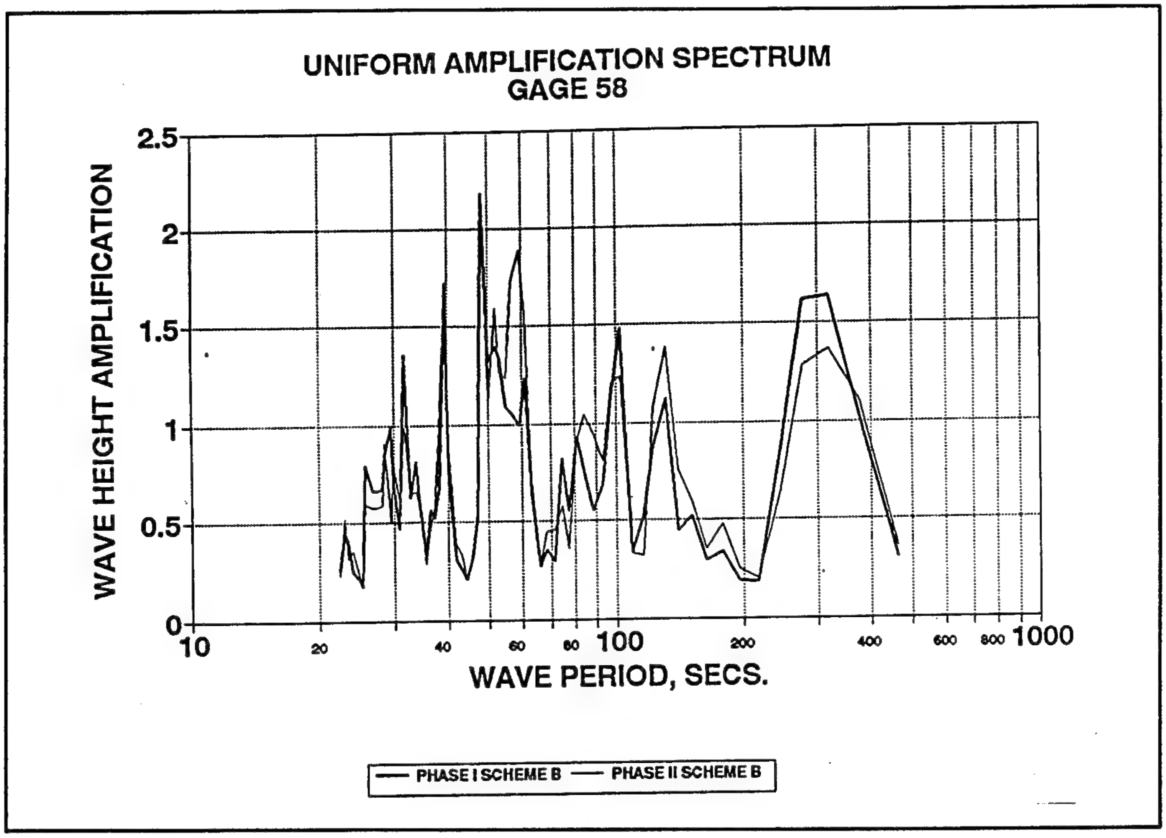

UNIFORM AMPLIFICATION SPECTRUM
GAGE 53
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
7
8
9
10
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

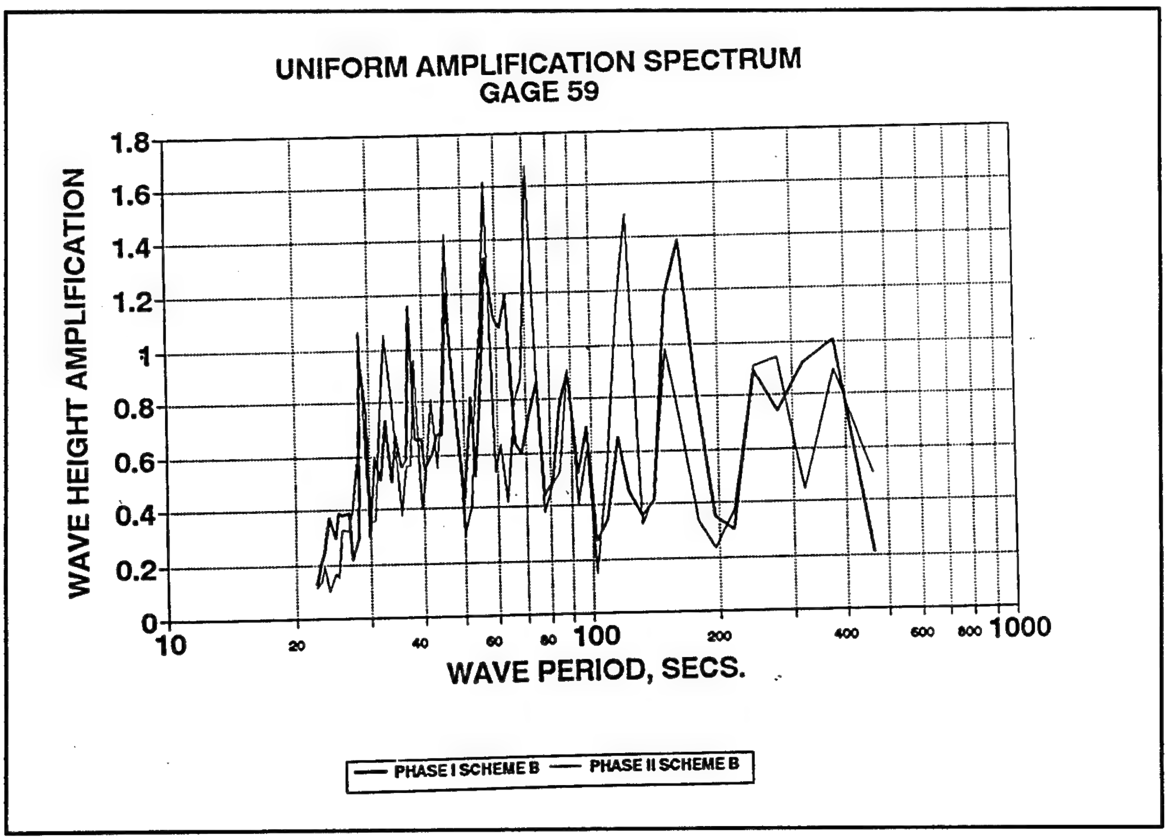

UNIFORM AMPLIFICATION SPECTRUM
GAGE 54
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

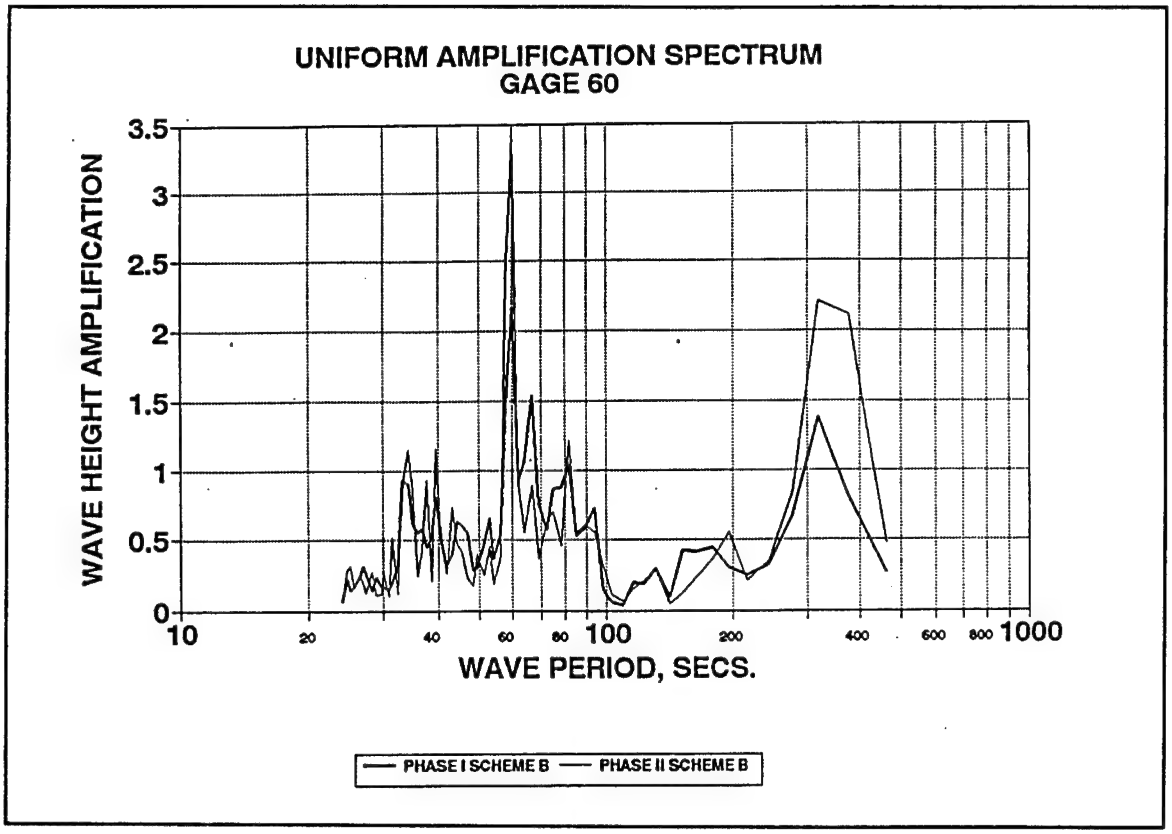

UNIFORM AMPLIFICATION SPECTRUM
GAGE 55
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

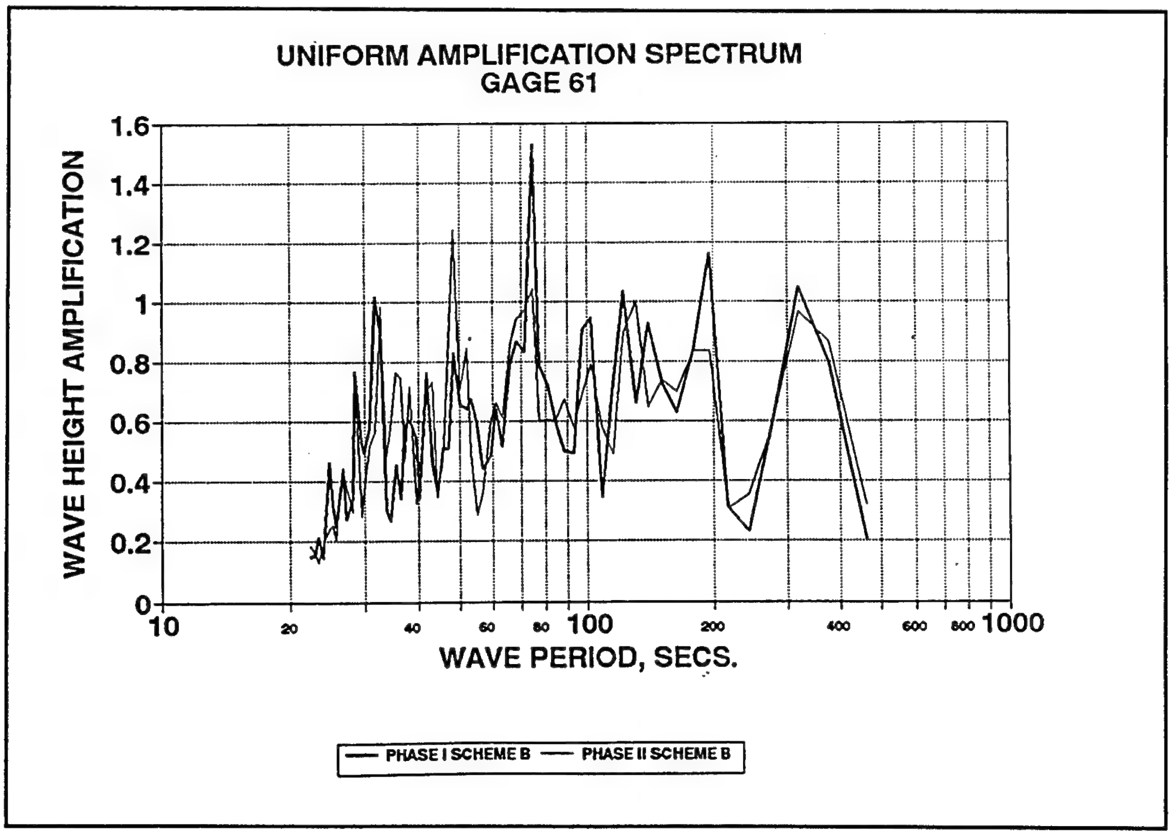

UNIFORM AMPLIFICATION SPECTRUM
GAGE 56
WAVE HEIGHT AMPLIFICATION
0
2
4
6
8
10
12
14
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

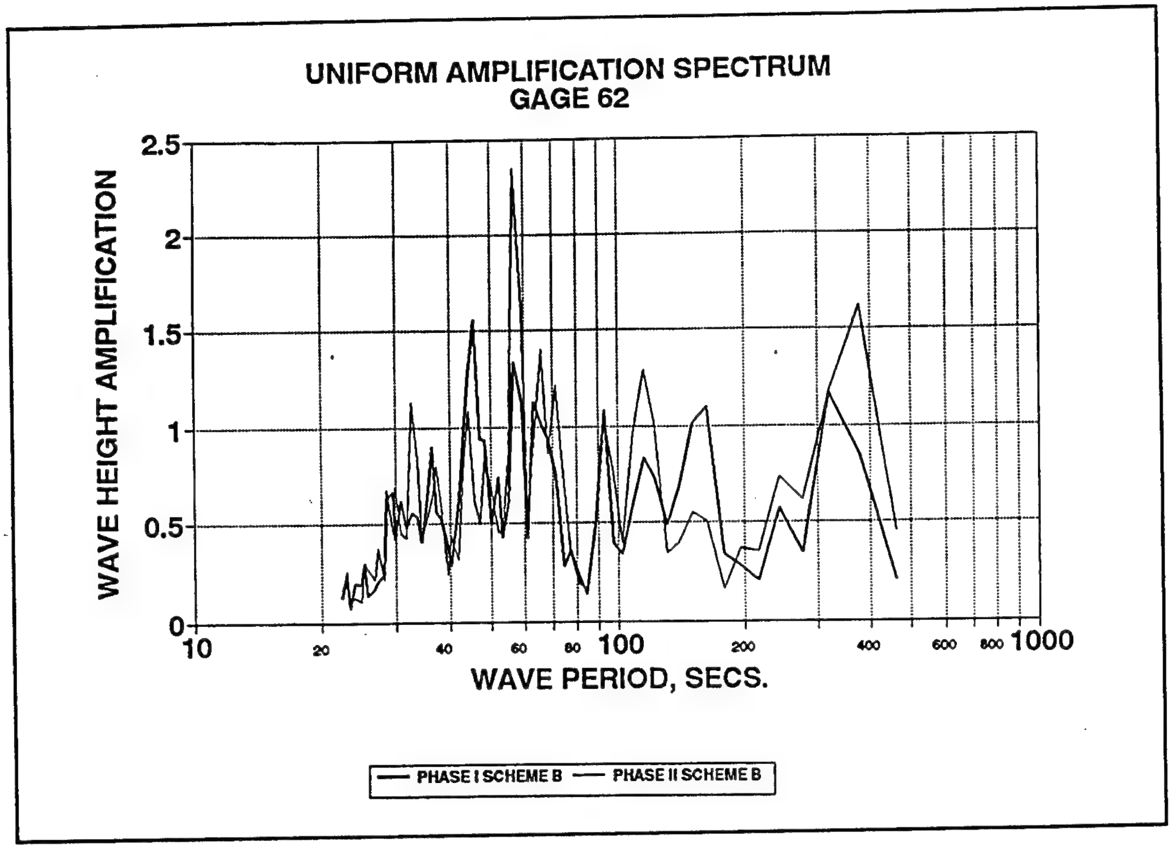

UNIFORM AMPLIFICATION SPECTRUM
GAGE 57
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B


UNIFORM AMPLIFICATION SPECTRUM
GAGE 58
WAVE HEIGHT AMPLIFICATION
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

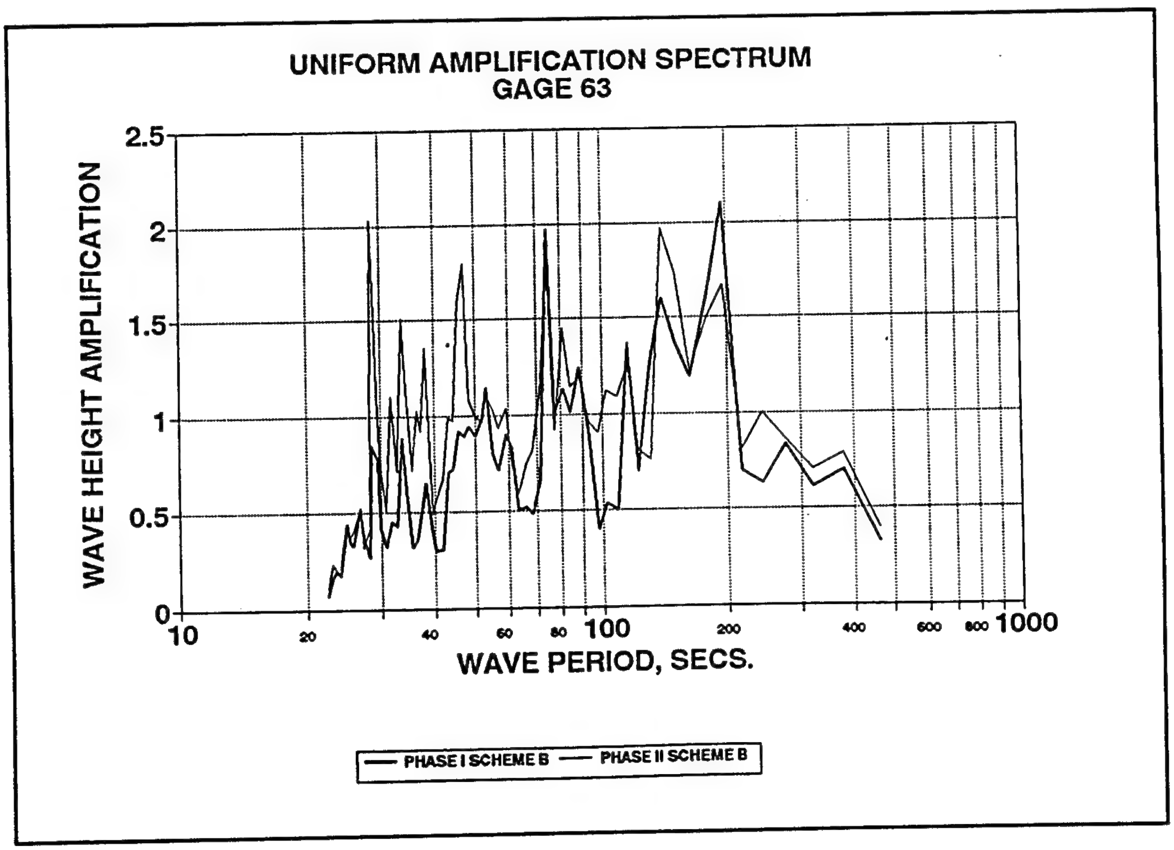

UNIFORM AMPLIFICATION SPECTRUM
GAGE 59
WAVE HEIGHT AMPLIFICATION
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B


UNIFORM AMPLIFICATION SPECTRUM
GAGE 60
WAVE HEIGHT AMPLIFICATION
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

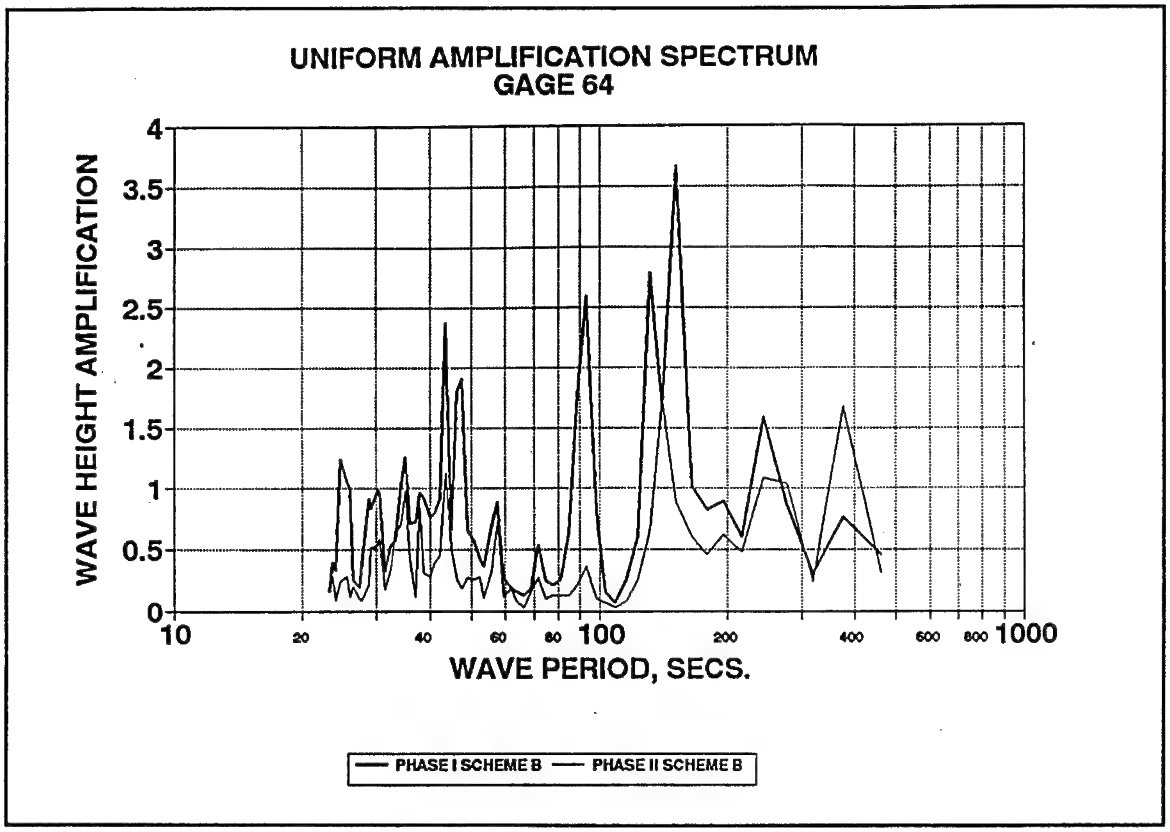

UNIFORM AMPLIFICATION SPECTRUM
GAGE 61
WAVE HEIGHT AMPLIFICATION
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

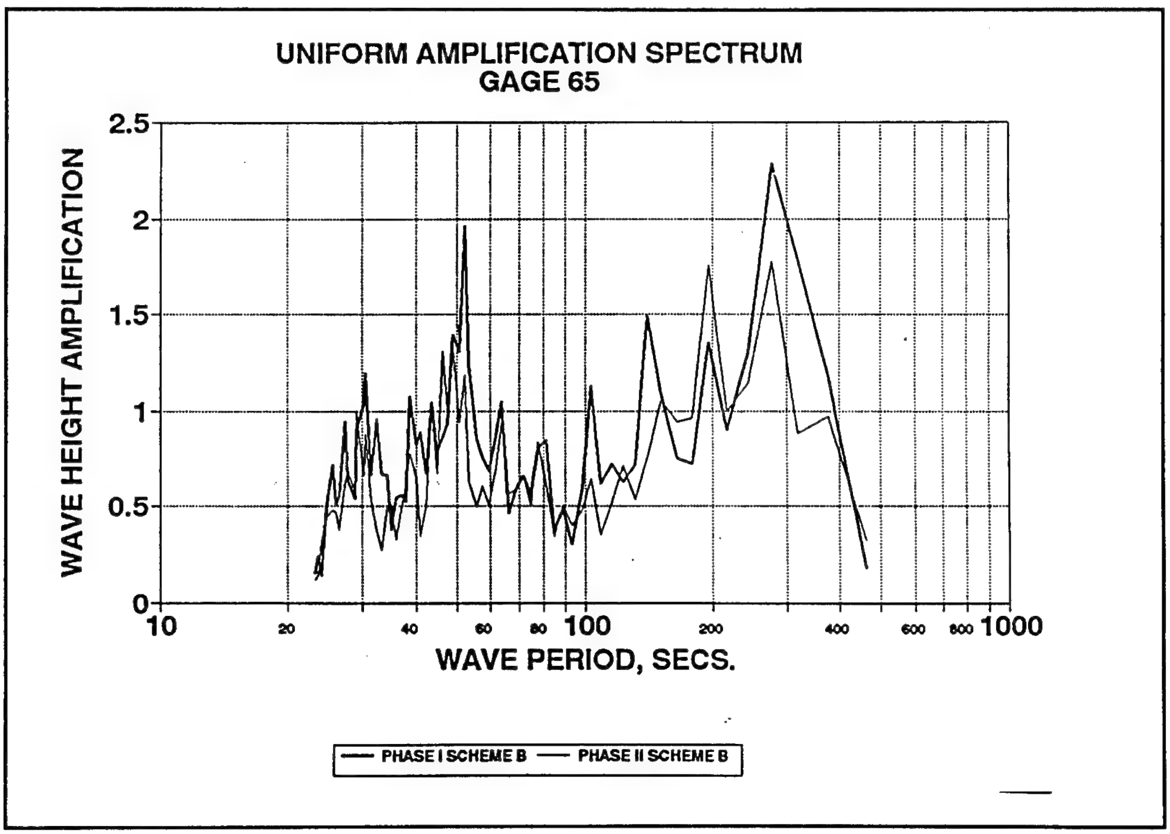


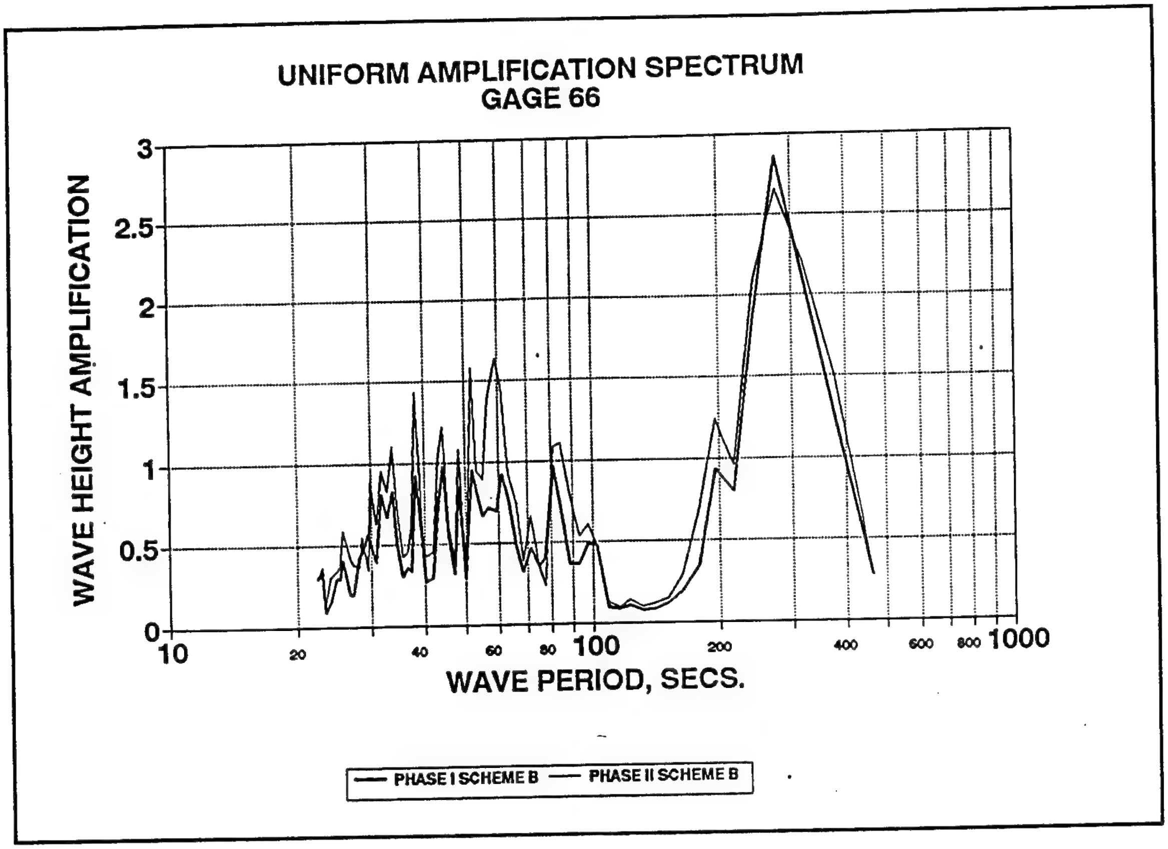
UNIFORM AMPLIFICATION SPECTRUM
GAGE 62
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

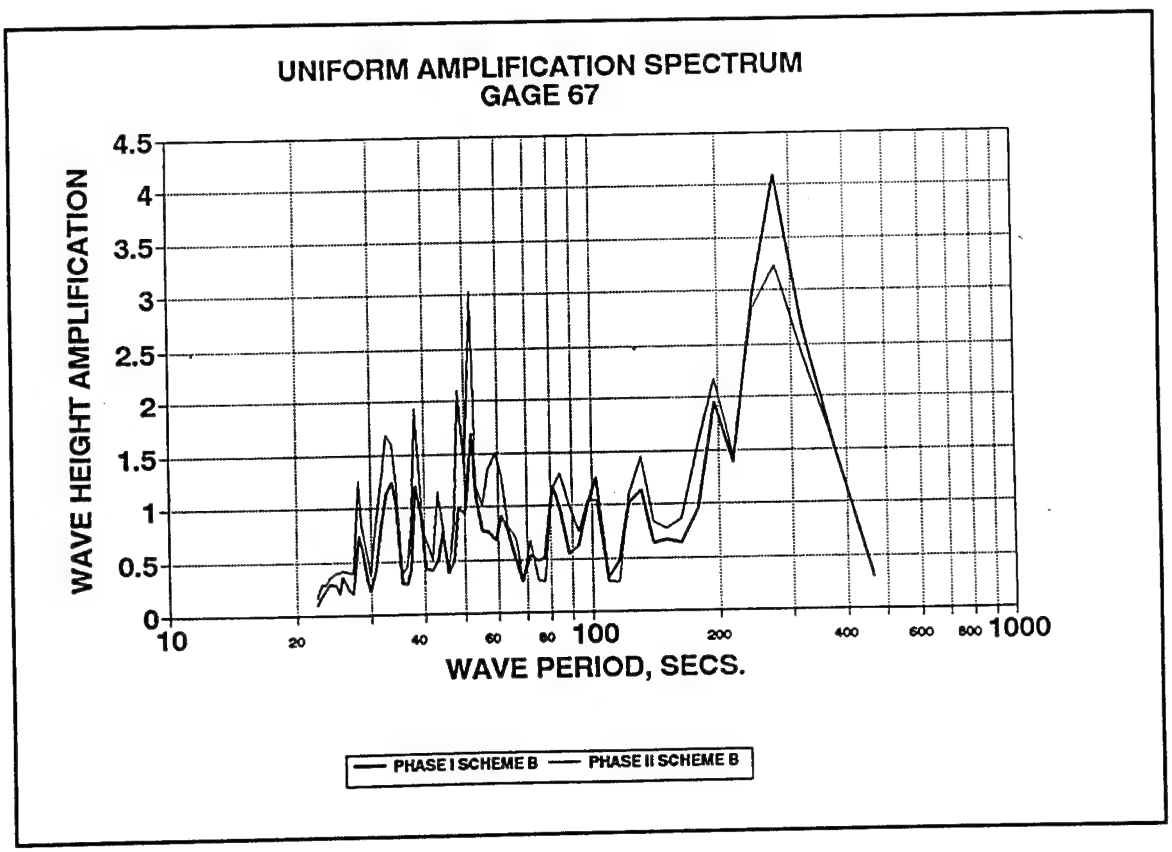



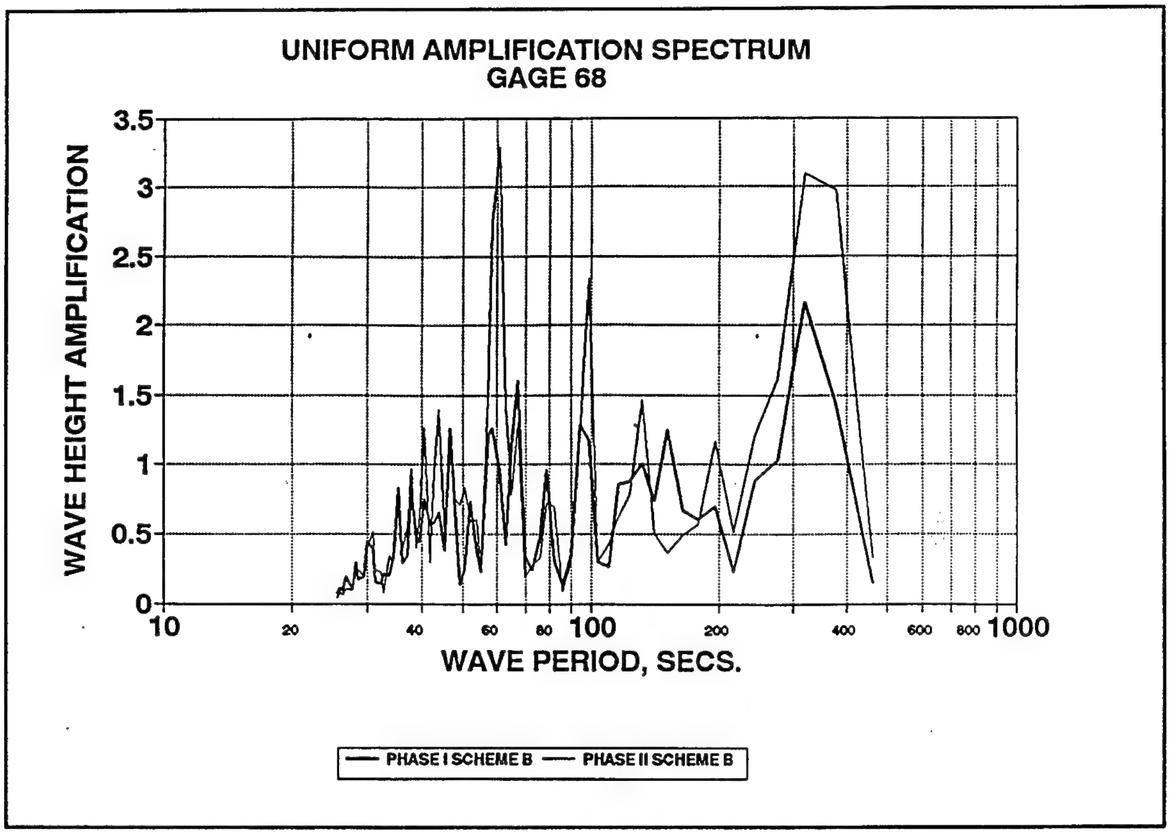
UNIFORM AMPLIFICATION SPECTRUM
GAGE 63
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B


UNIFORM AMPLIFICATION SPECTRUM
GAGE 64
WAVE HEIGHT AMPLIFICATION
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

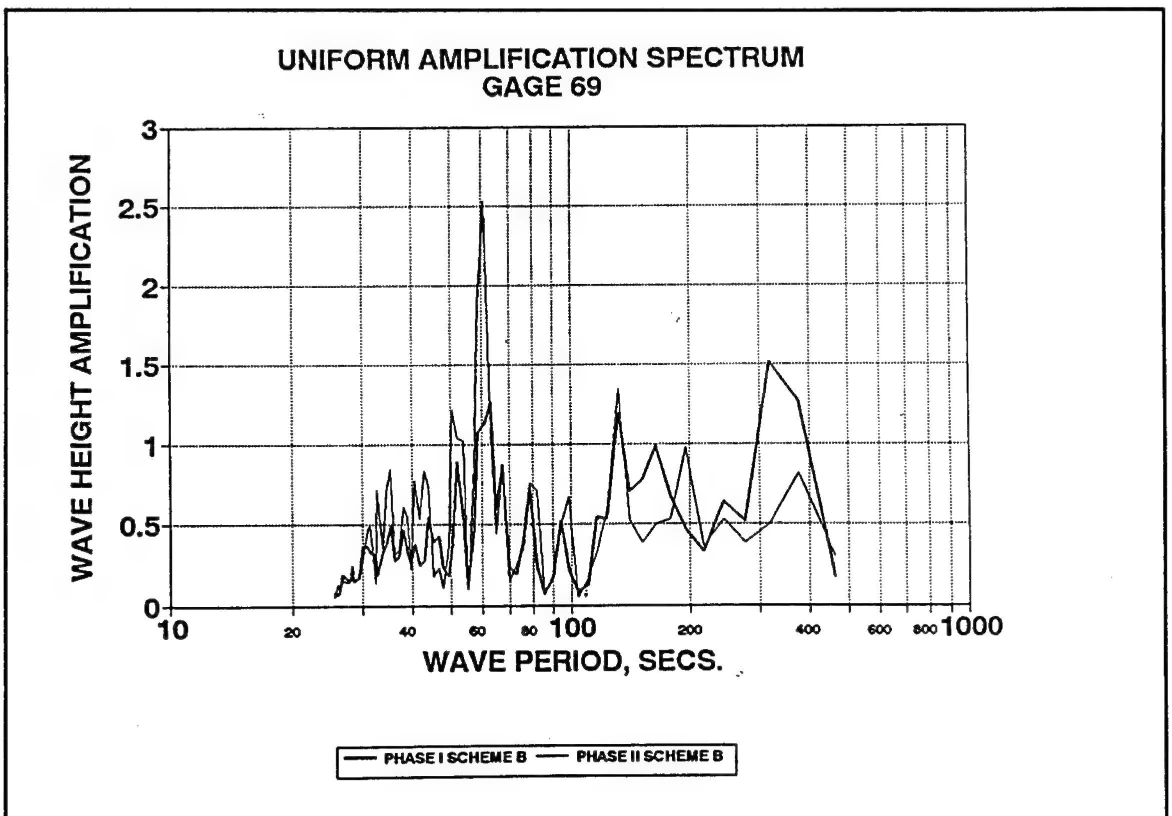

UNIFORM AMPLIFICATION SPECTRUM
GAGE 65
WAVE HEIGHT AMPLIFICATION
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B


UNIFORM AMPLIFICATION SPECTRUM
GAGE 66
WAVE HEIGHT AMPLIFICATION
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

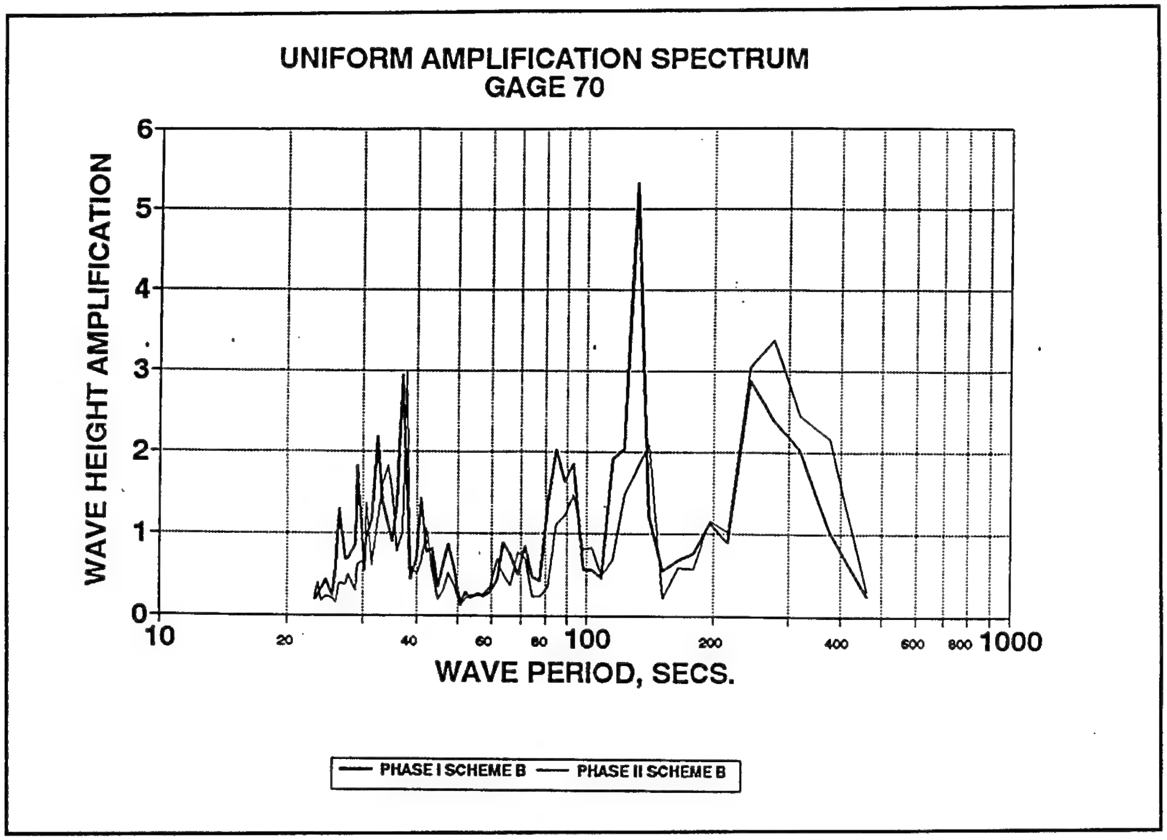

UNIFORM AMPLIFICATION SPECTRUM
GAGE 67
WAVE HEIGHT AMPLIFICATION
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

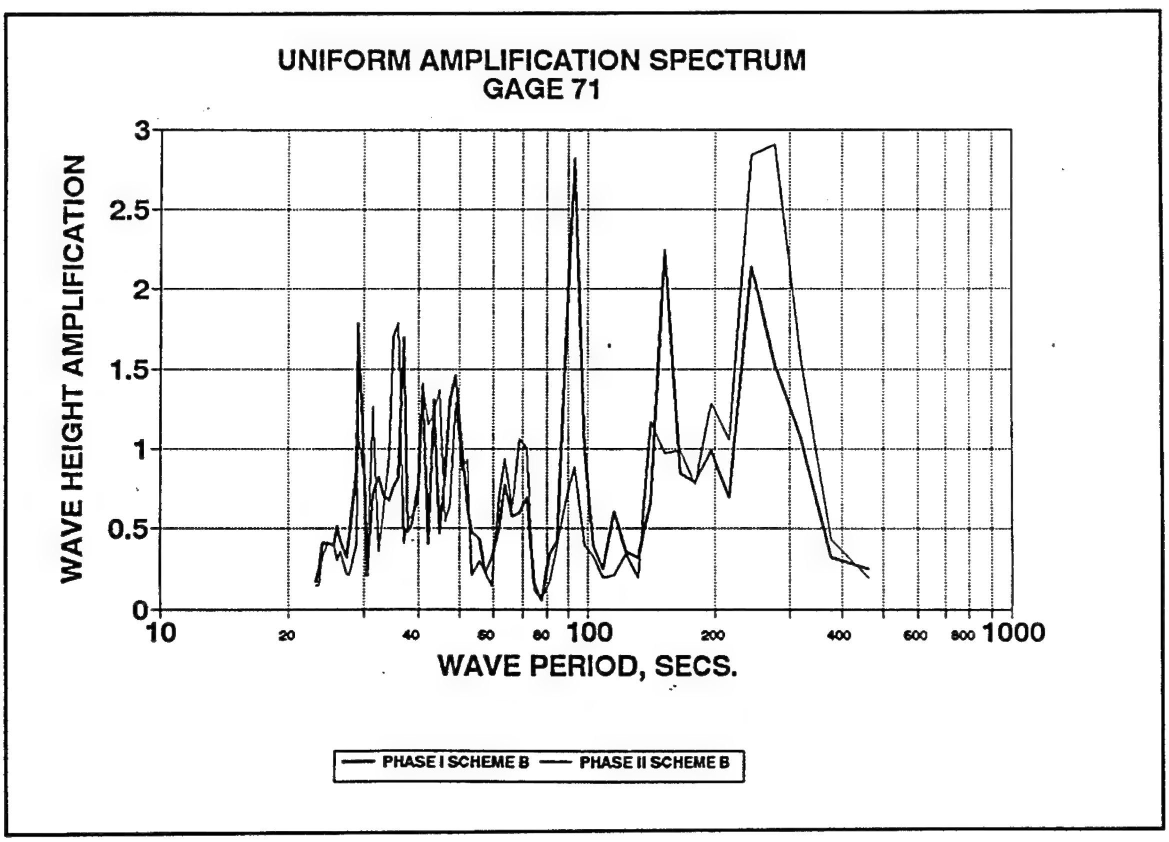


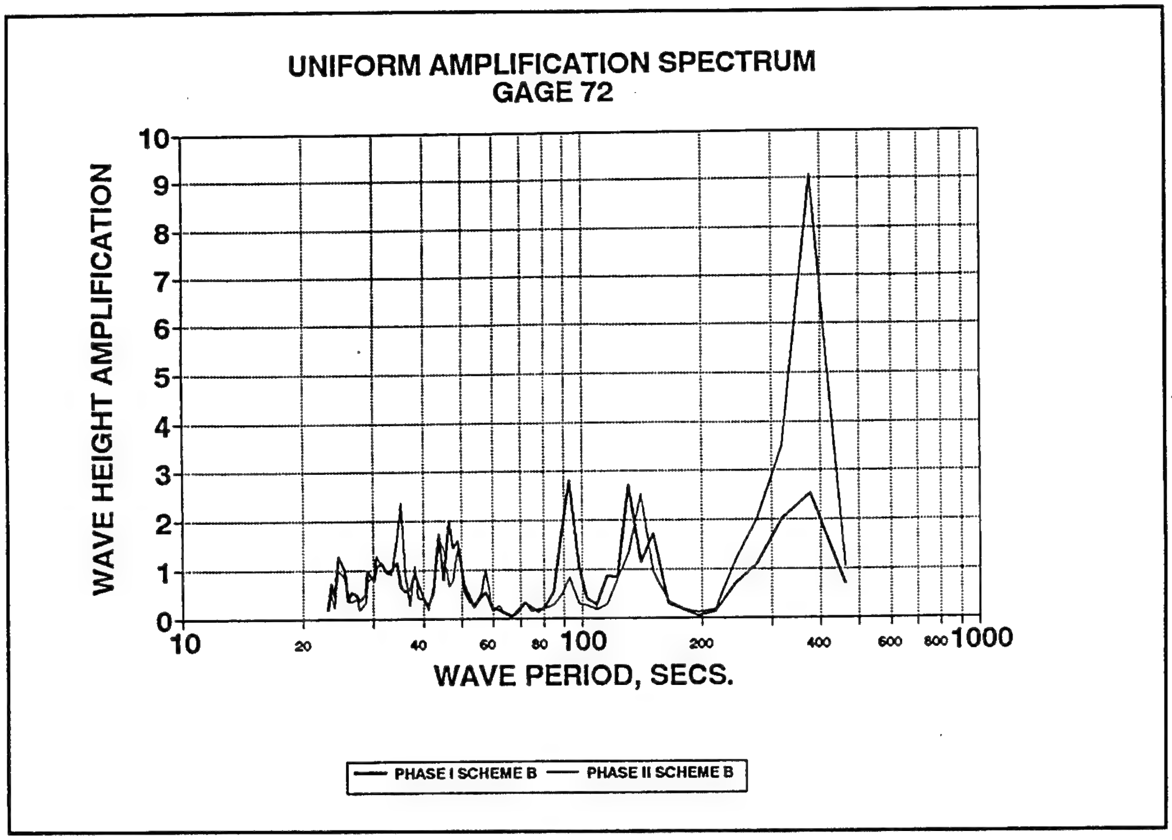
UNIFORM AMPLIFICATION SPECTRUM
GAGE 68
WAVE HEIGHT AMPLIFICATION
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

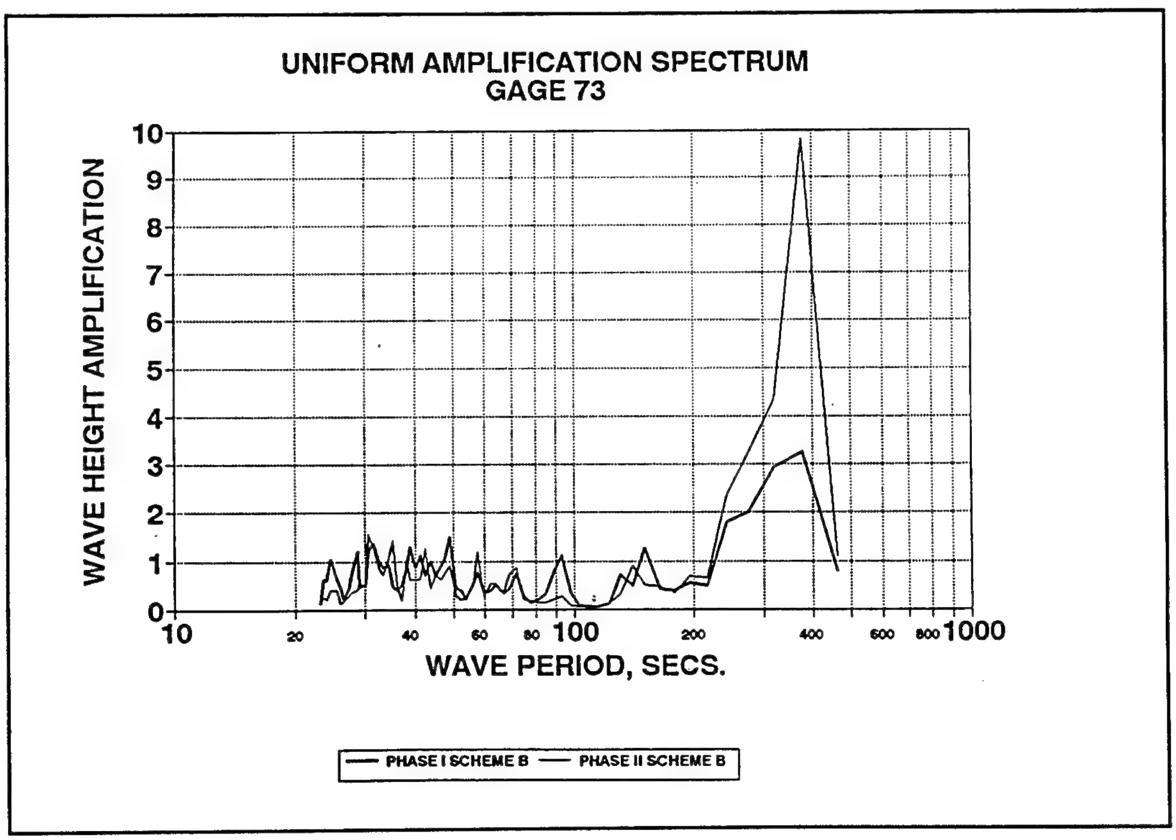



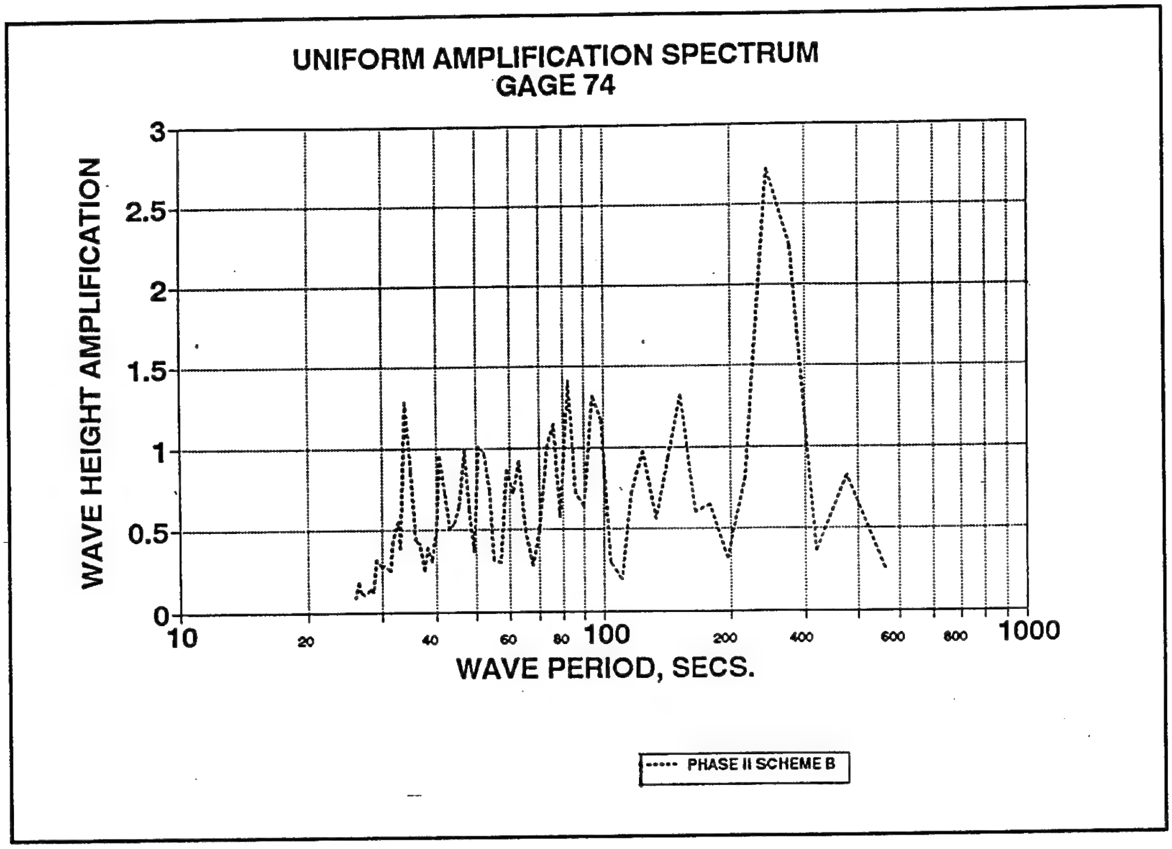
UNIFORM AMPLIFICATION SPECTRUM
GAGE 69
WAVE HEIGHT AMPLIFICATION
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

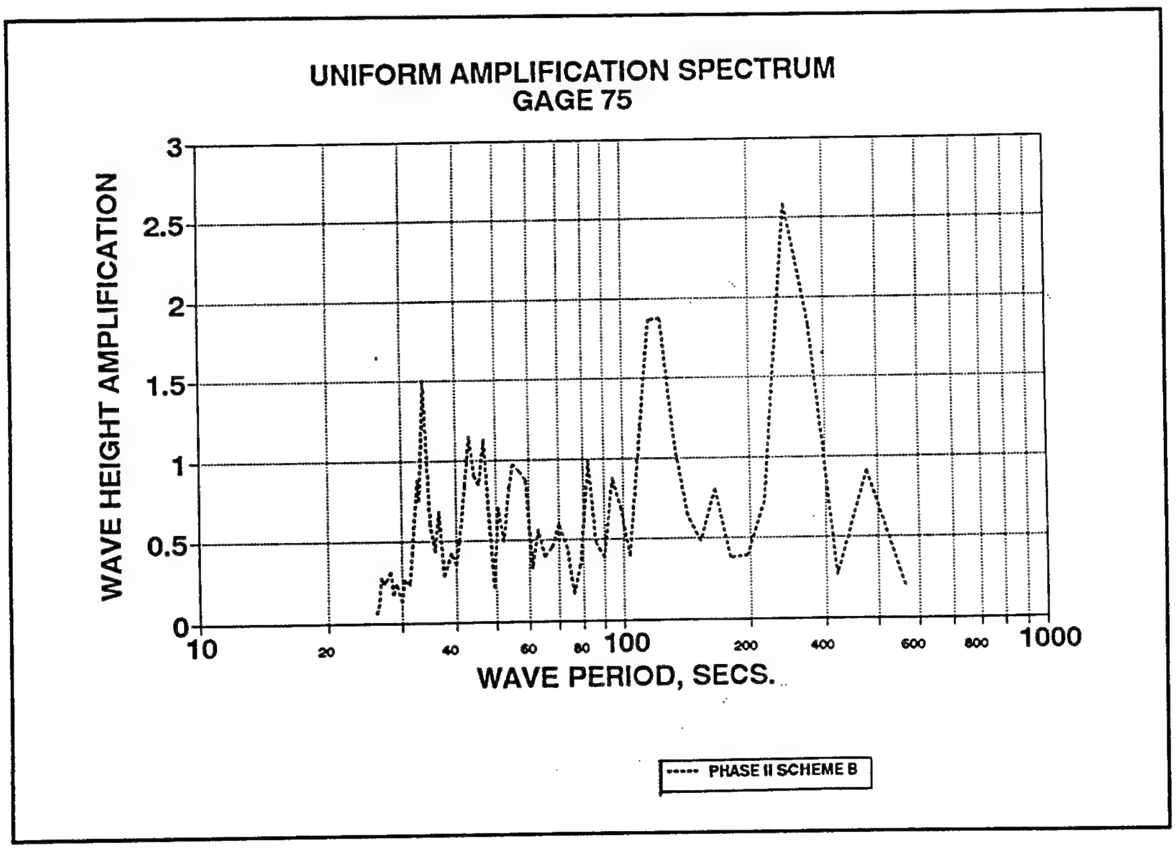

UNIFORM AMPLIFICATION SPECTRUM
GAGE 70
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

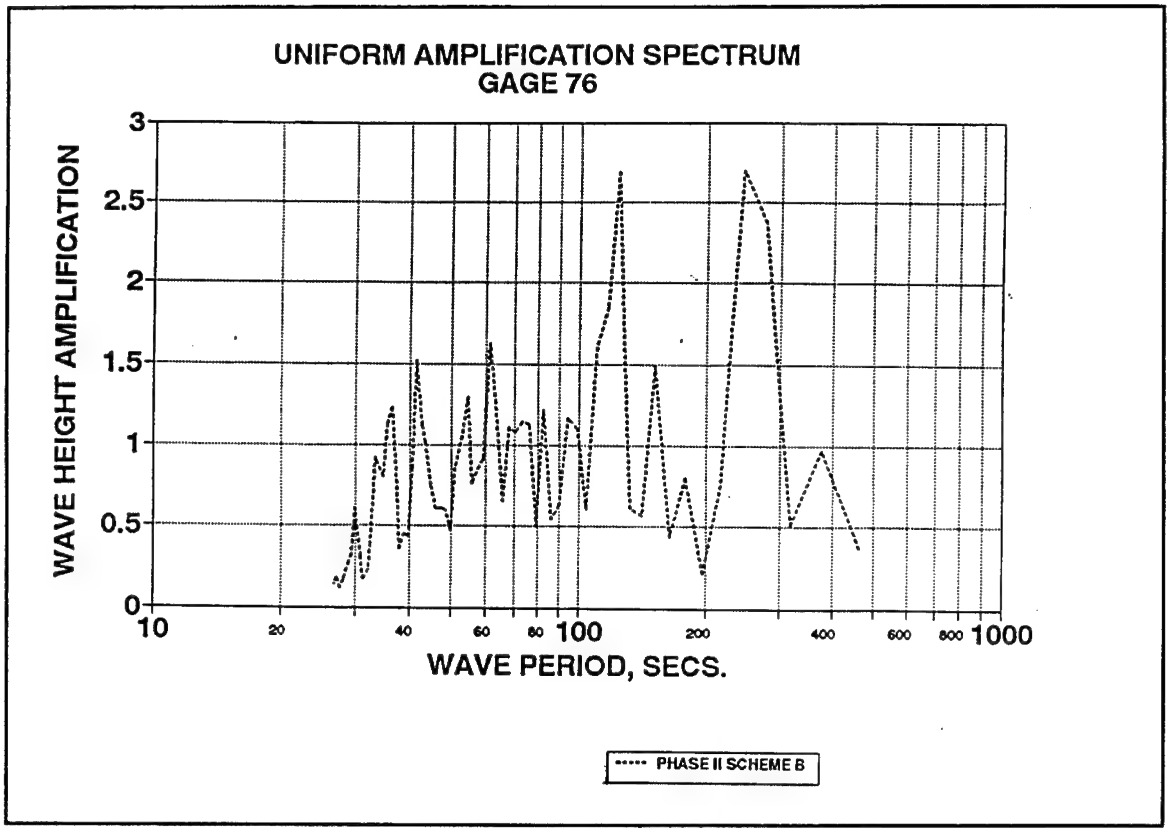

UNIFORM AMPLIFICATION SPECTRUM
GAGE 71
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

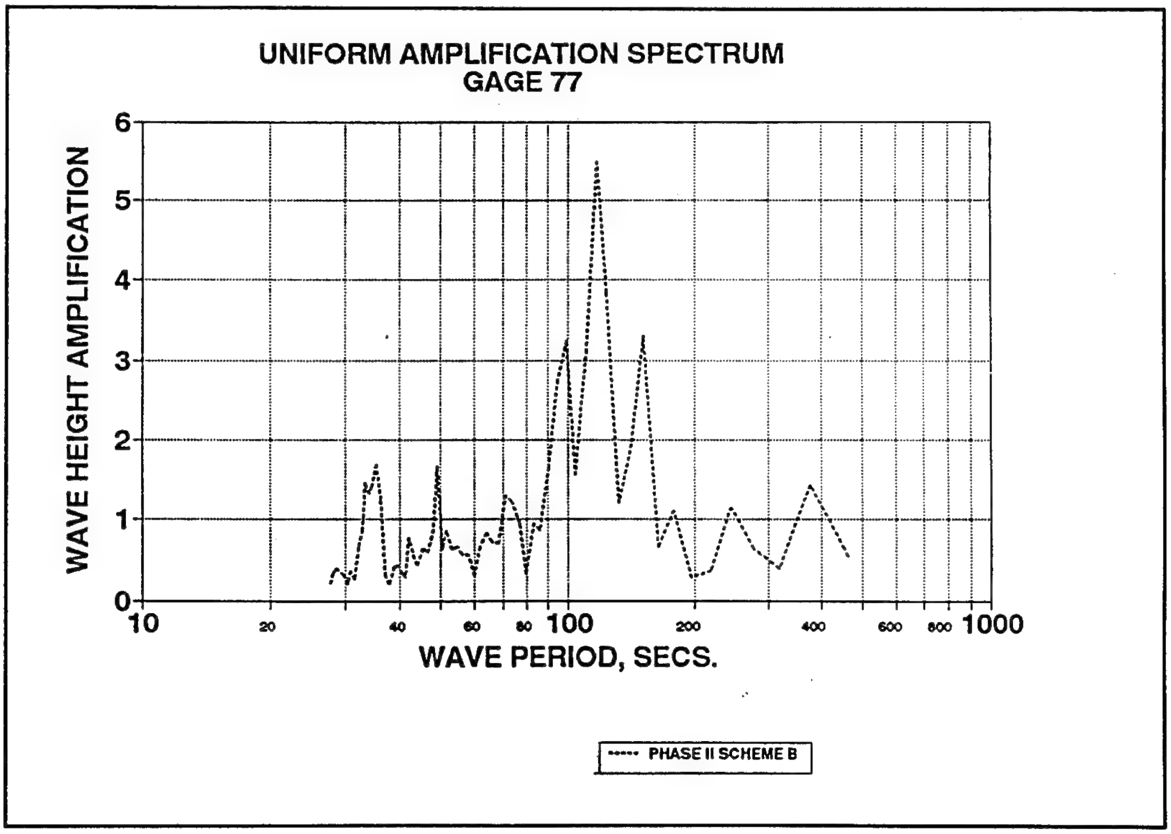

UNIFORM AMPLIFICATION SPECTRUM
GAGE 72
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
0
1
2
3
4
5
6
7
8
9
10
10
20
40
60
80
100
200
400
600
800
1000
PHASE I SCHEME B
PHASE II SCHEME B

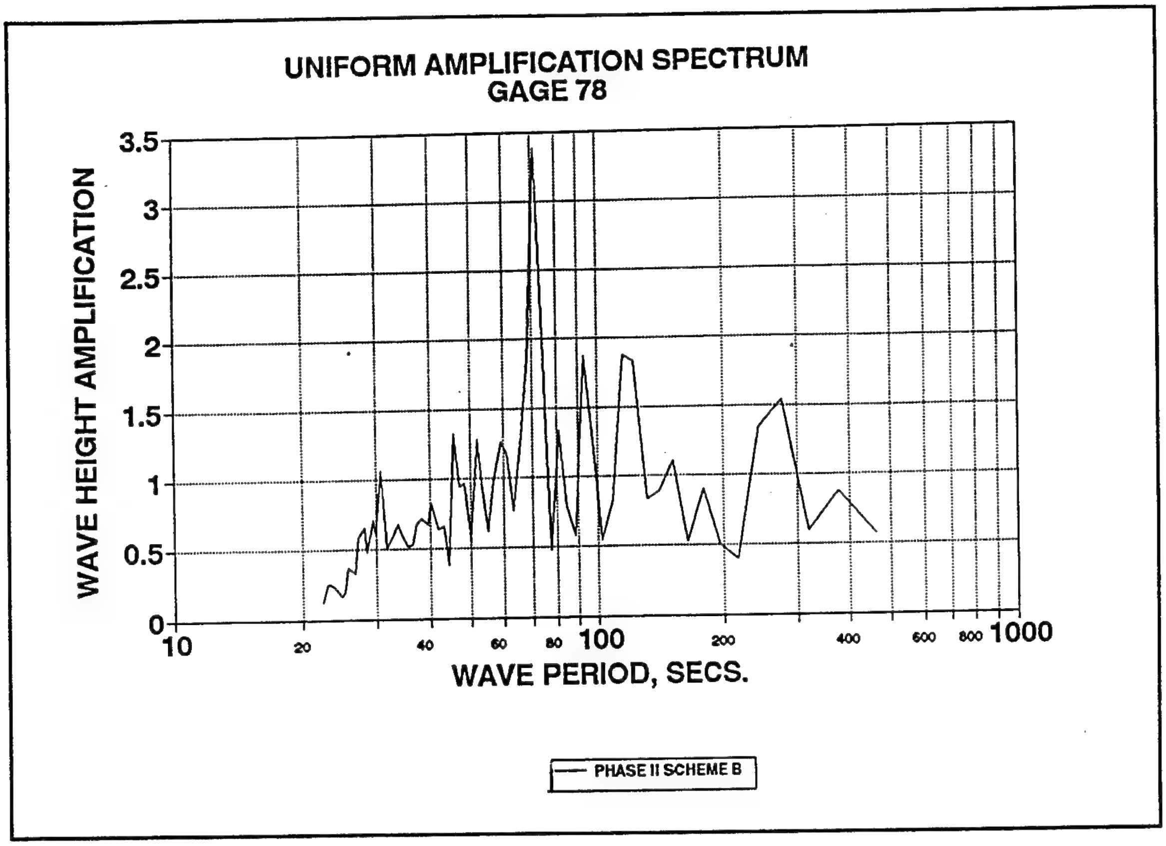

UNIFORM AMPLIFICATION SPECTRUM
GAGE 73
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
0
1
2
3
4
5
6
7
8
9
10
10
20
40
60
80
100
200
400
600
800
1000
PHASE I SCHEME B
PHASE II SCHEME B

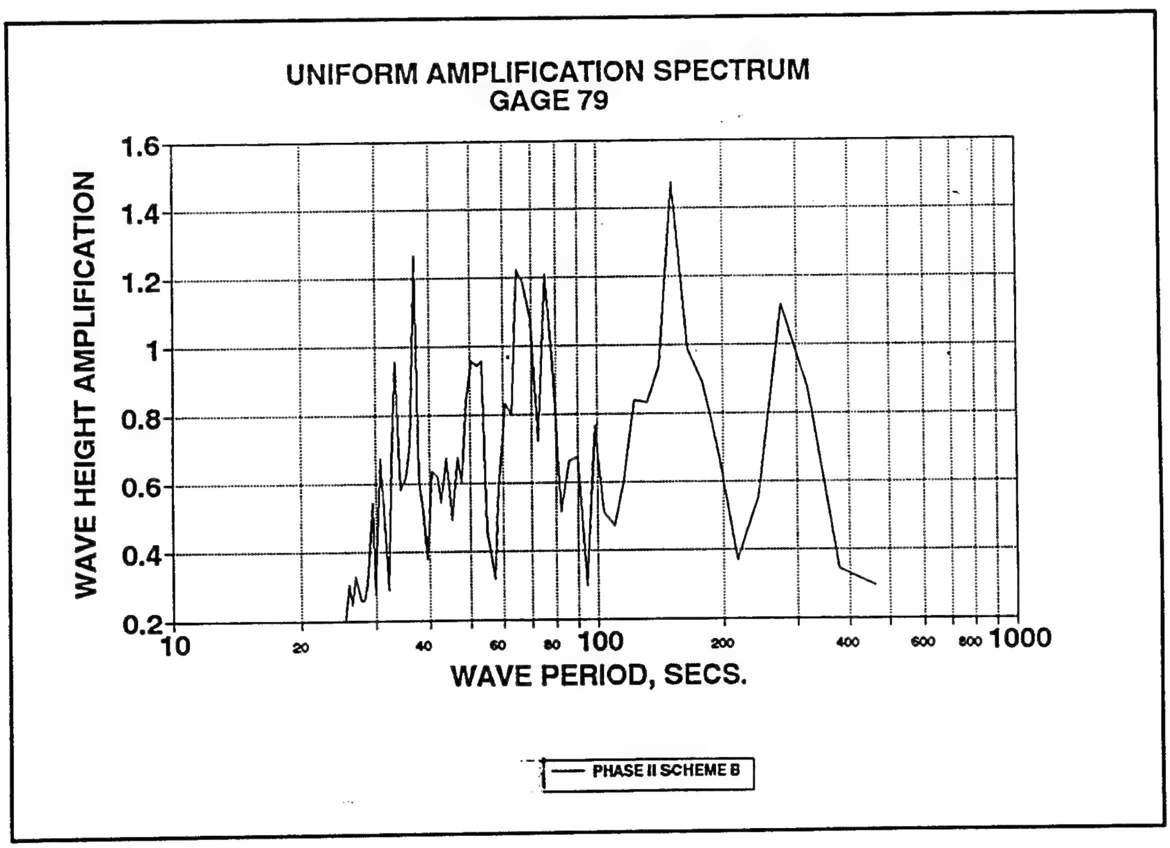

UNIFORM AMPLIFICATION SPECTRUM
GAGE 74
WAVE HEIGHT AMPLIFICATION
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B

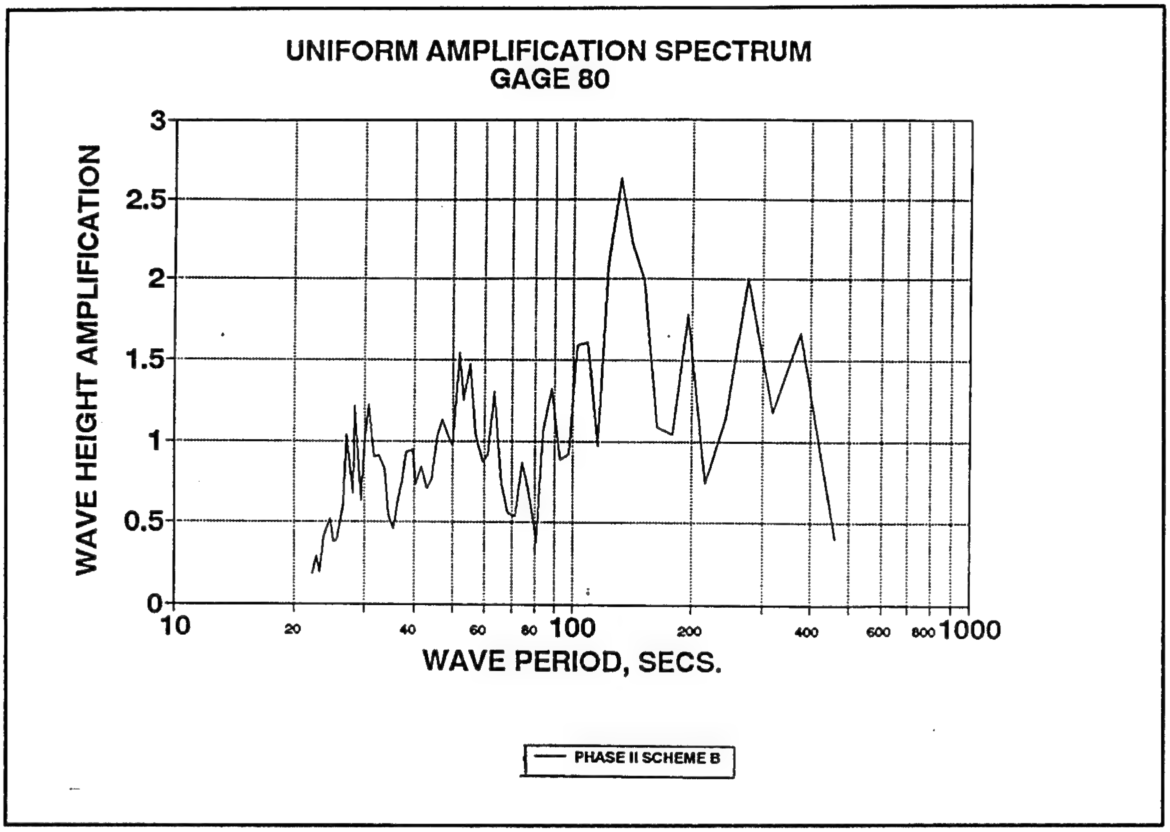

UNIFORM AMPLIFICATION SPECTRUM
GAGE 75
WAVE HEIGHT AMPLIFICATION
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B

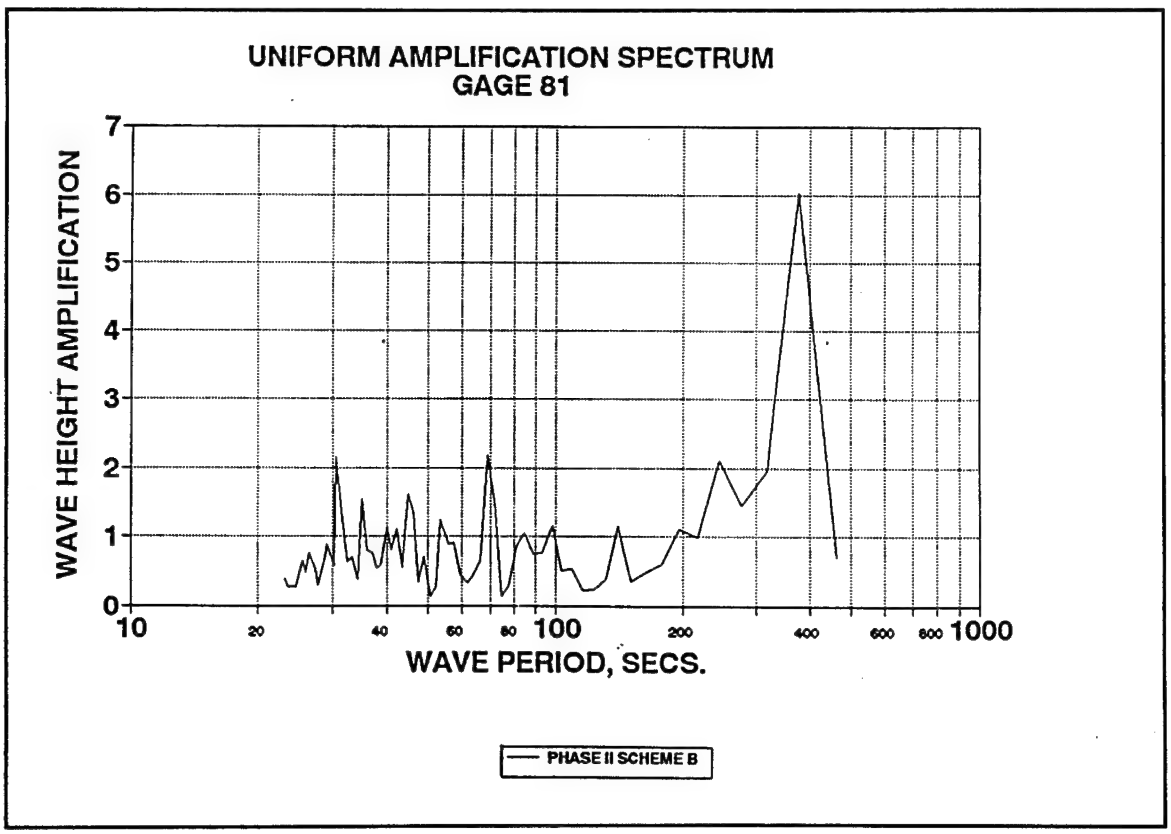

UNIFORM AMPLIFICATION SPECTRUM
GAGE 76
WAVE HEIGHT AMPLIFICATION
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B

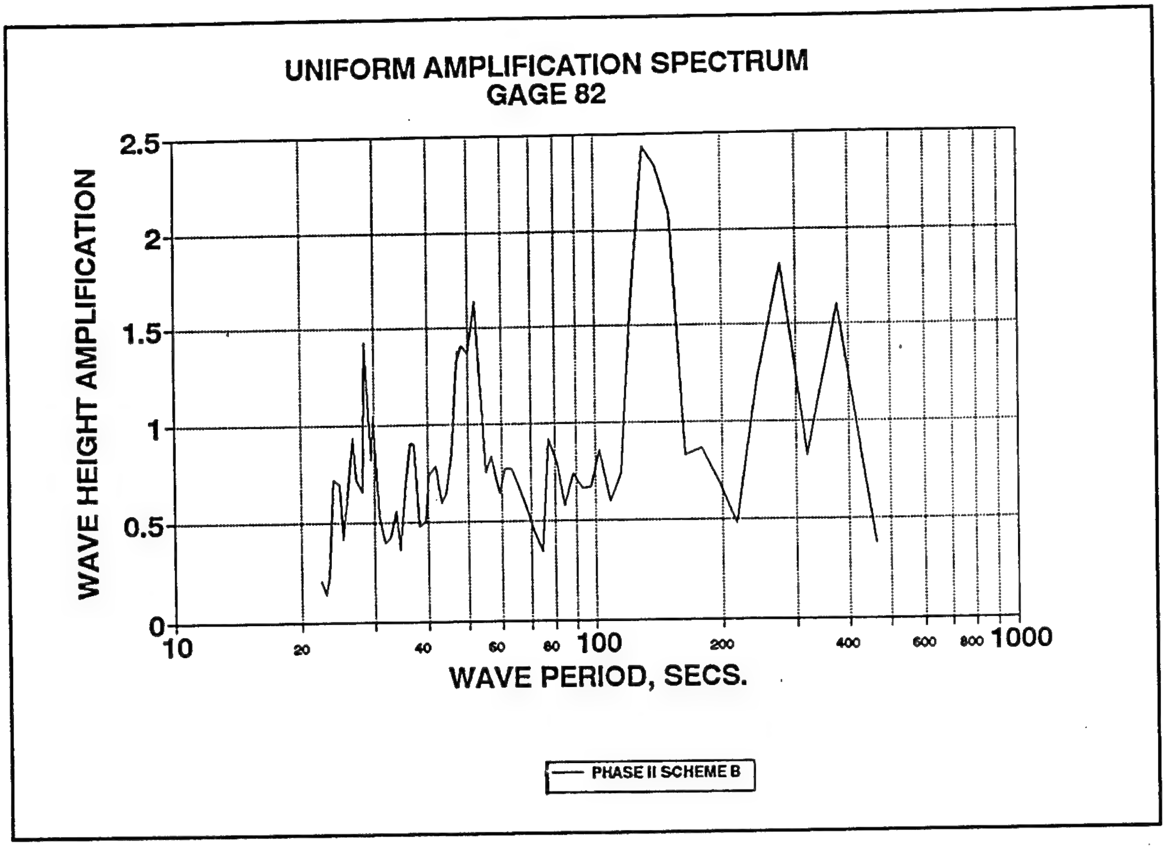

UNIFORM AMPLIFICATION SPECTRUM
GAGE 77
WAVE HEIGHT AMPLIFICATION
6
5
4
3
2
1
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B

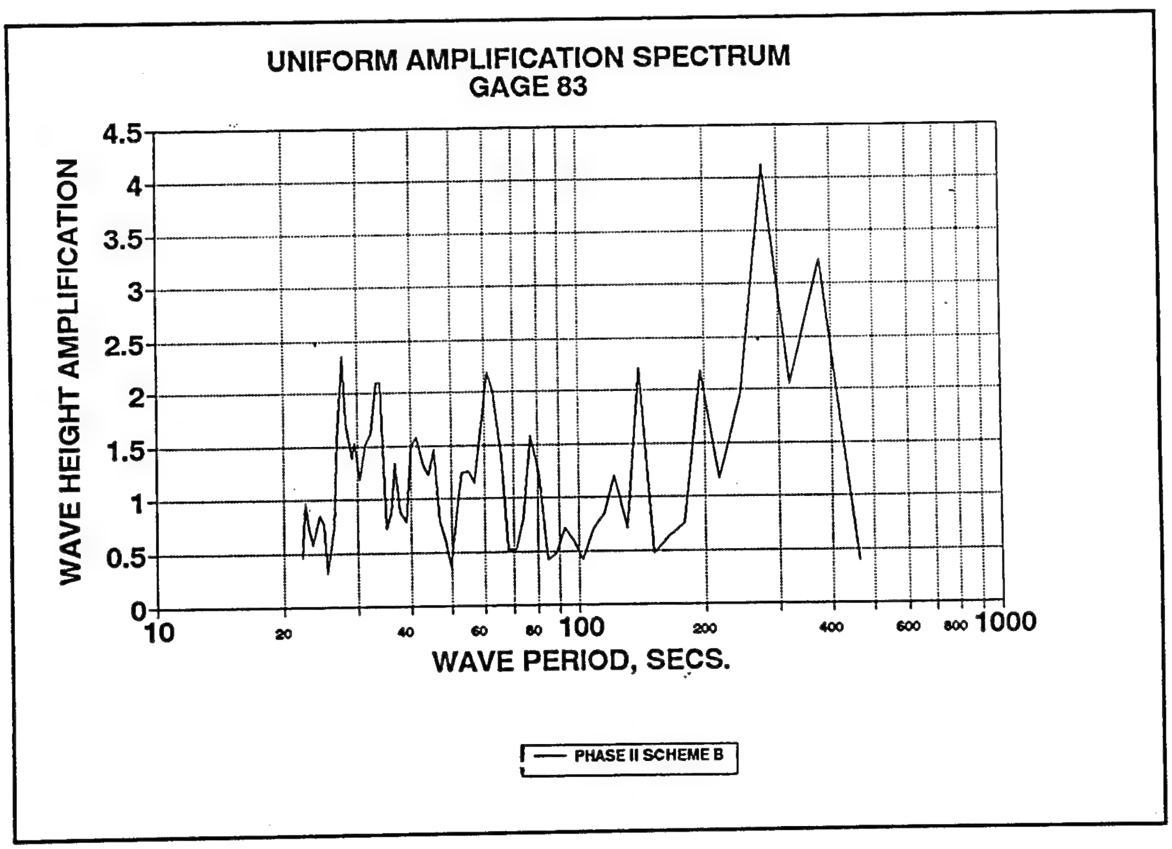

UNIFORM AMPLIFICATION SPECTRUM
GAGE 78
WAVE HEIGHT AMPLIFICATION
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B

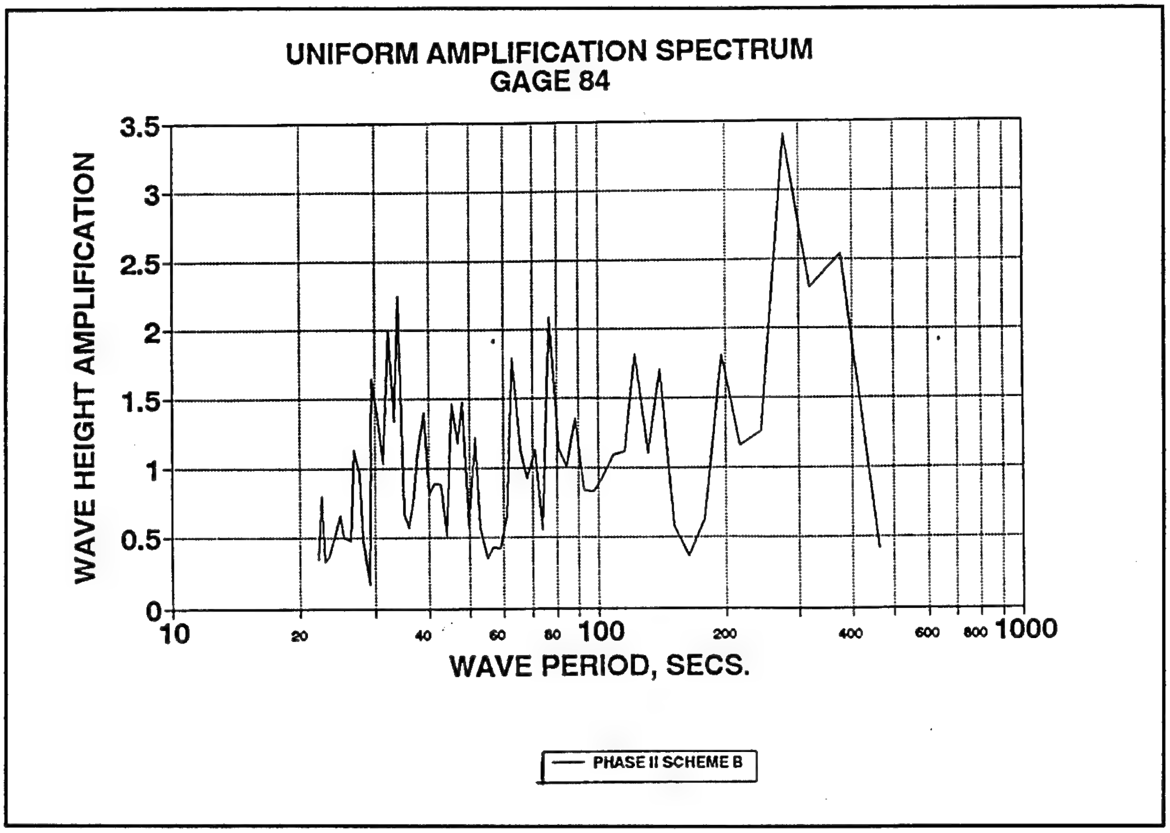

UNIFORM AMPLIFICATION SPECTRUM
GAGE 79
WAVE HEIGHT AMPLIFICATION
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B

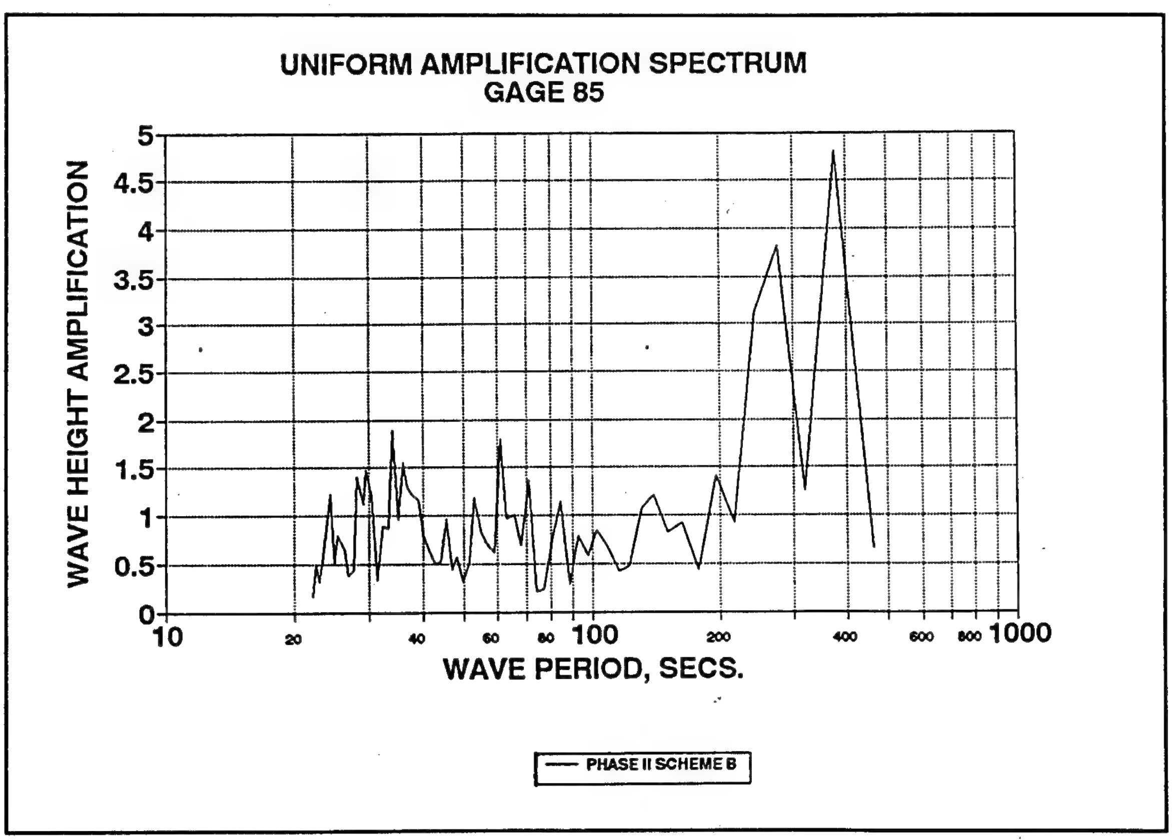

UNIFORM AMPLIFICATION SPECTRUM
GAGE 80
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B

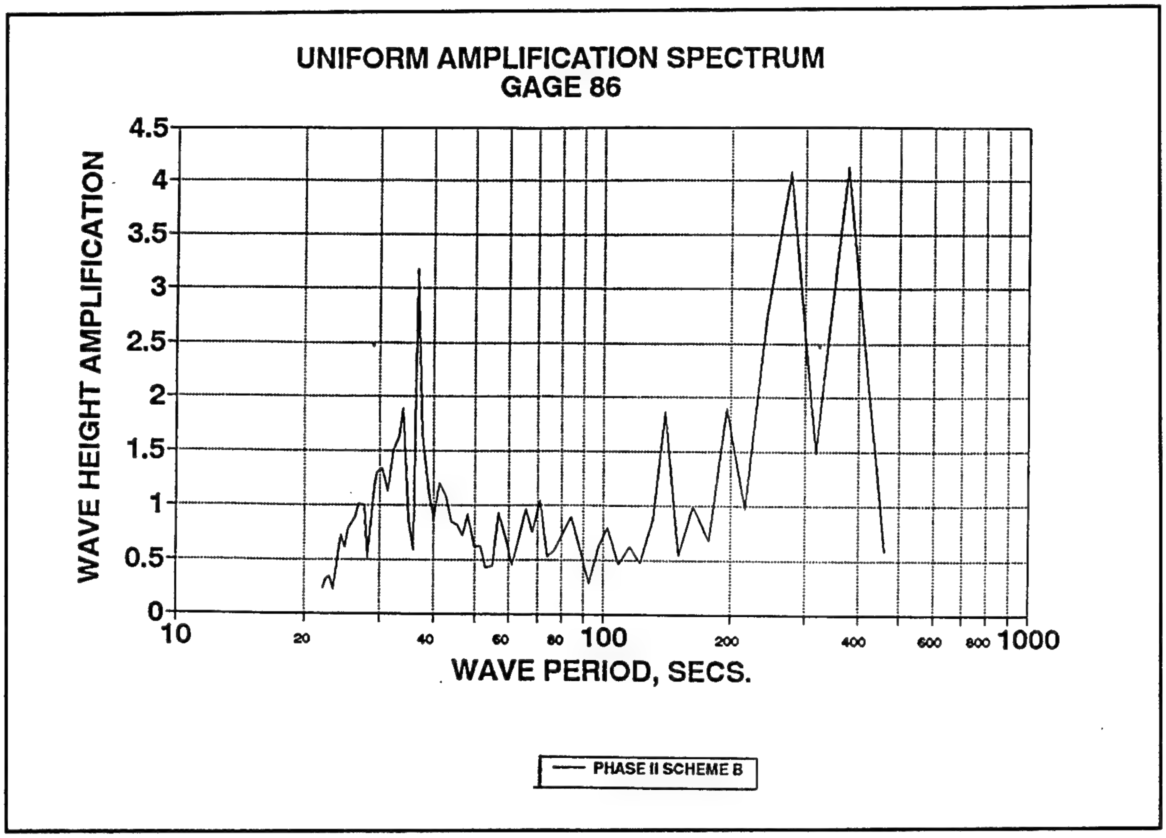

UNIFORM AMPLIFICATION SPECTRUM
GAGE 81
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
7
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B

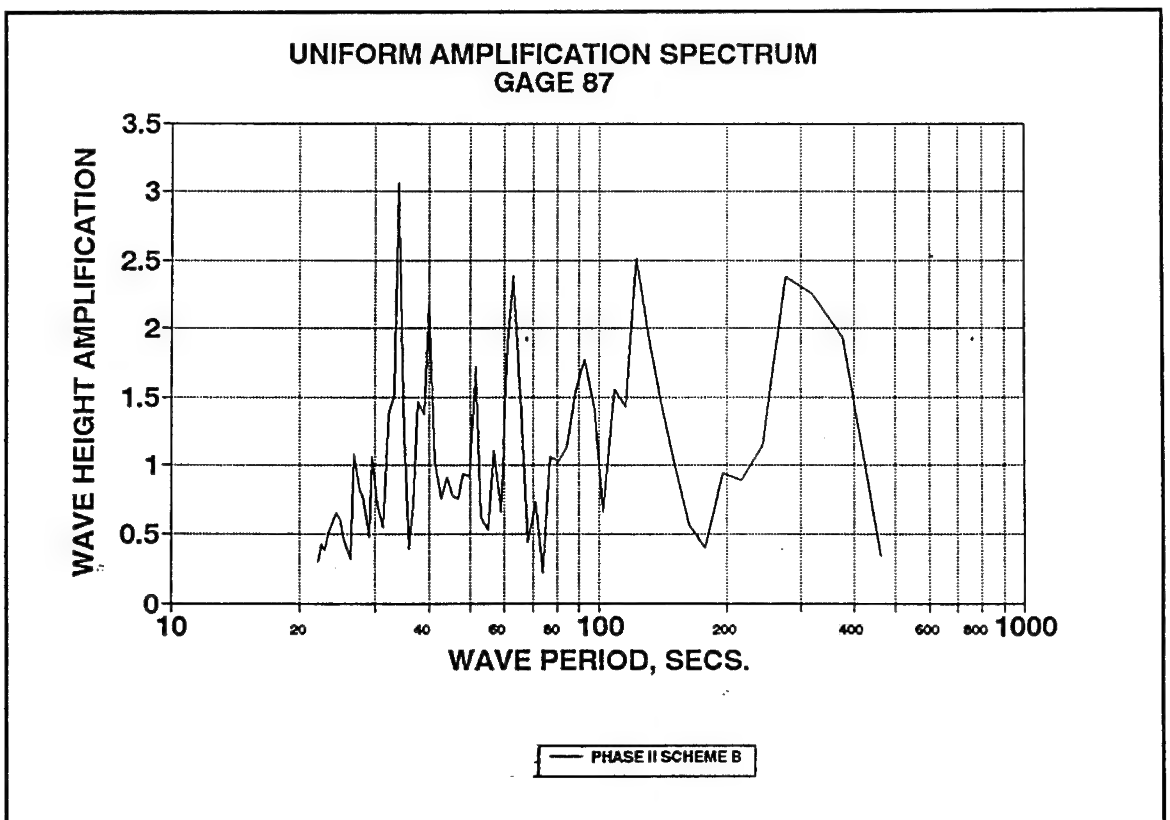

UNIFORM AMPLIFICATION SPECTRUM
GAGE 82
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B


UNIFORM AMPLIFICATION SPECTRUM
GAGE 83
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B

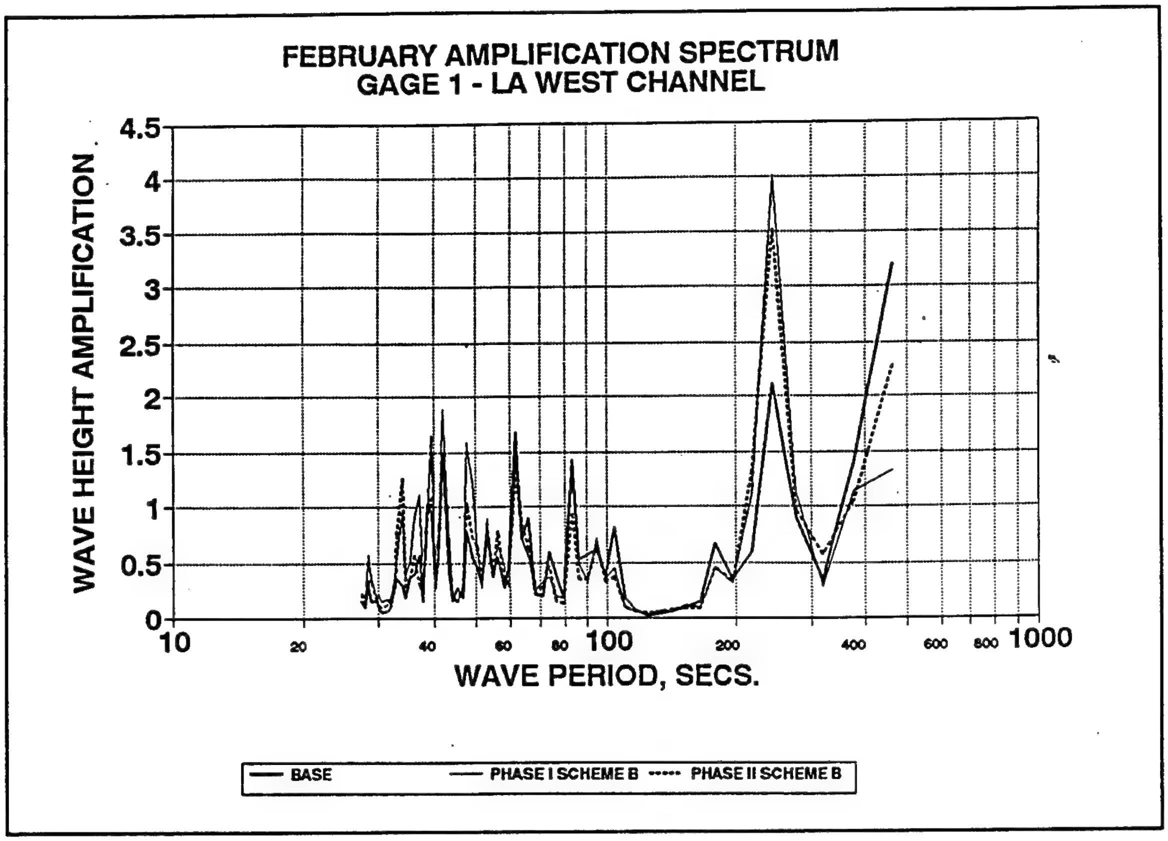

UNIFORM AMPLIFICATION SPECTRUM
GAGE 84
WAVE HEIGHT AMPLIFICATION
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B

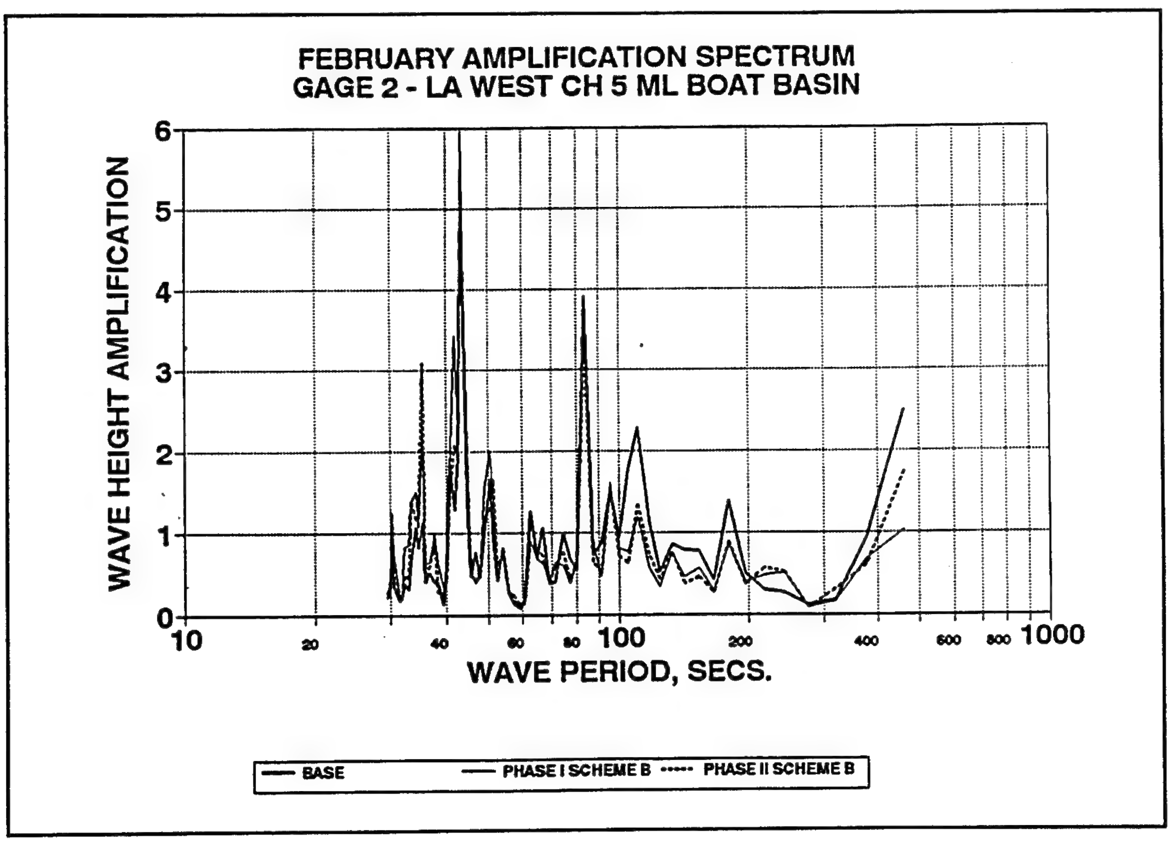

UNIFORM AMPLIFICATION SPECTRUM
GAGE 85
WAVE HEIGHT AMPLIFICATION
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B

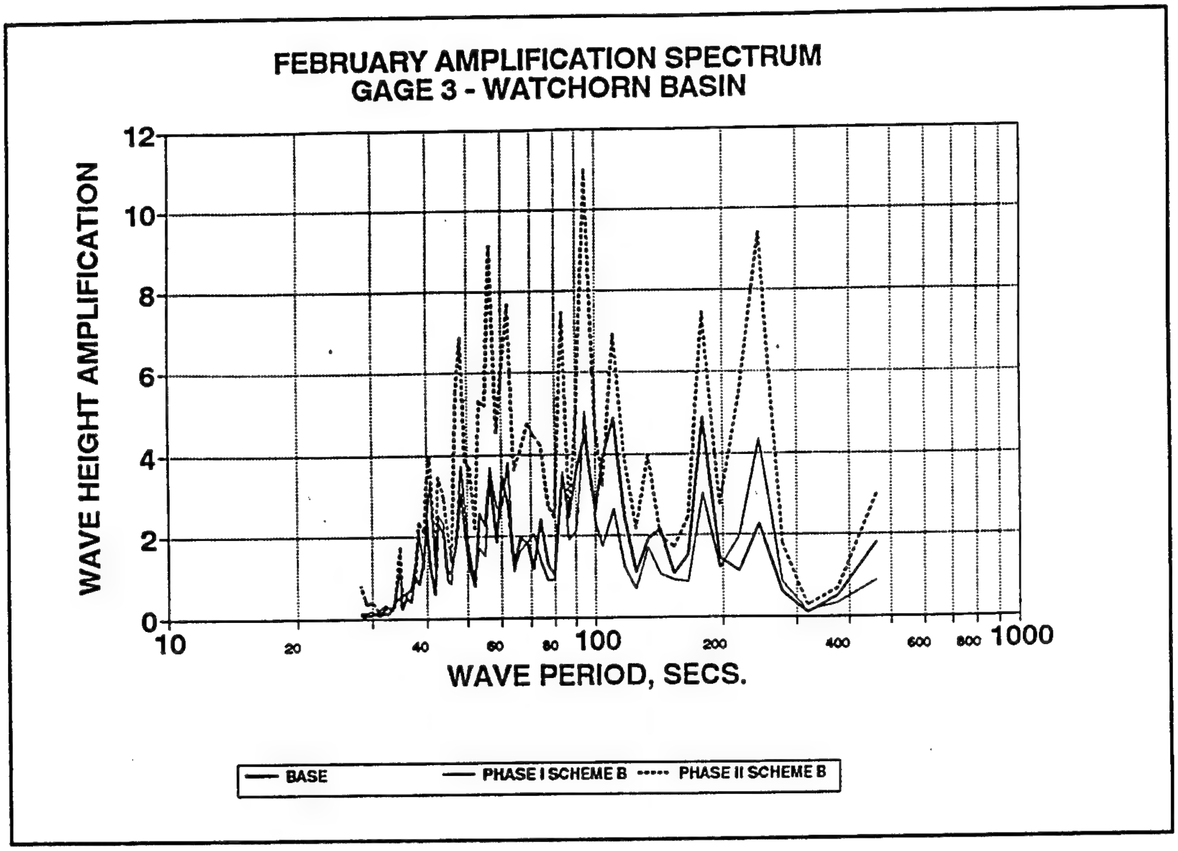

UNIFORM AMPLIFICATION SPECTRUM
GAGE 86
WAVE HEIGHT AMPLIFICATION
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B

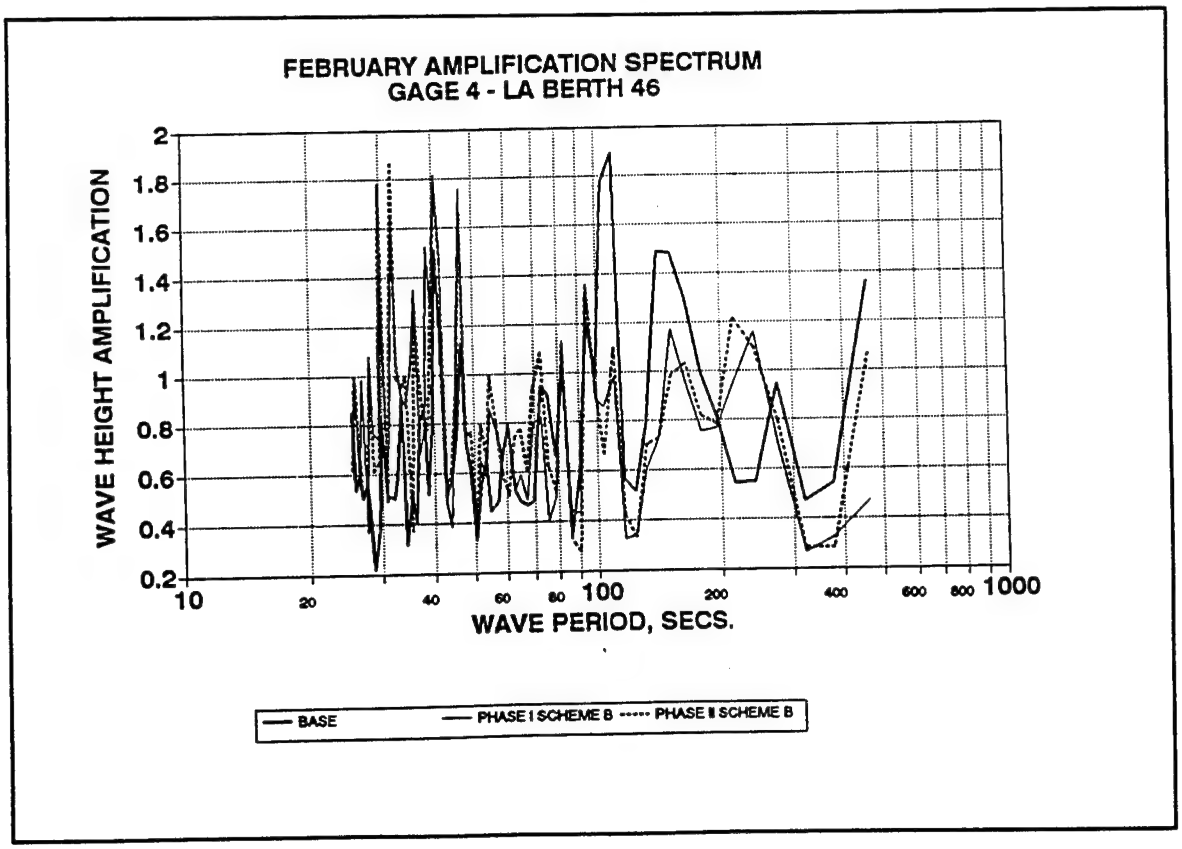

UNIFORM AMPLIFICATION SPECTRUM
GAGE 87
WAVE HEIGHT AMPLIFICATION
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B

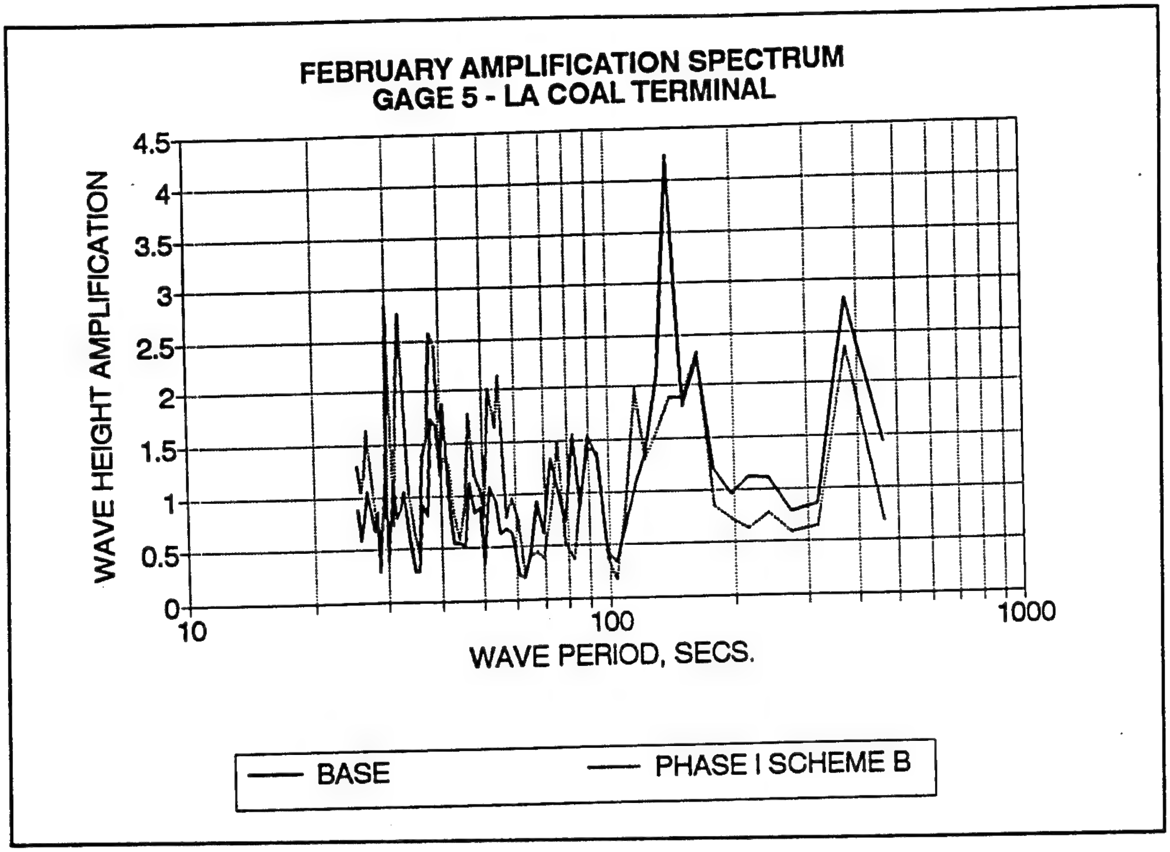
# Appendix C
# February Spectrum Test Results (Phases I and II, Scheme B)

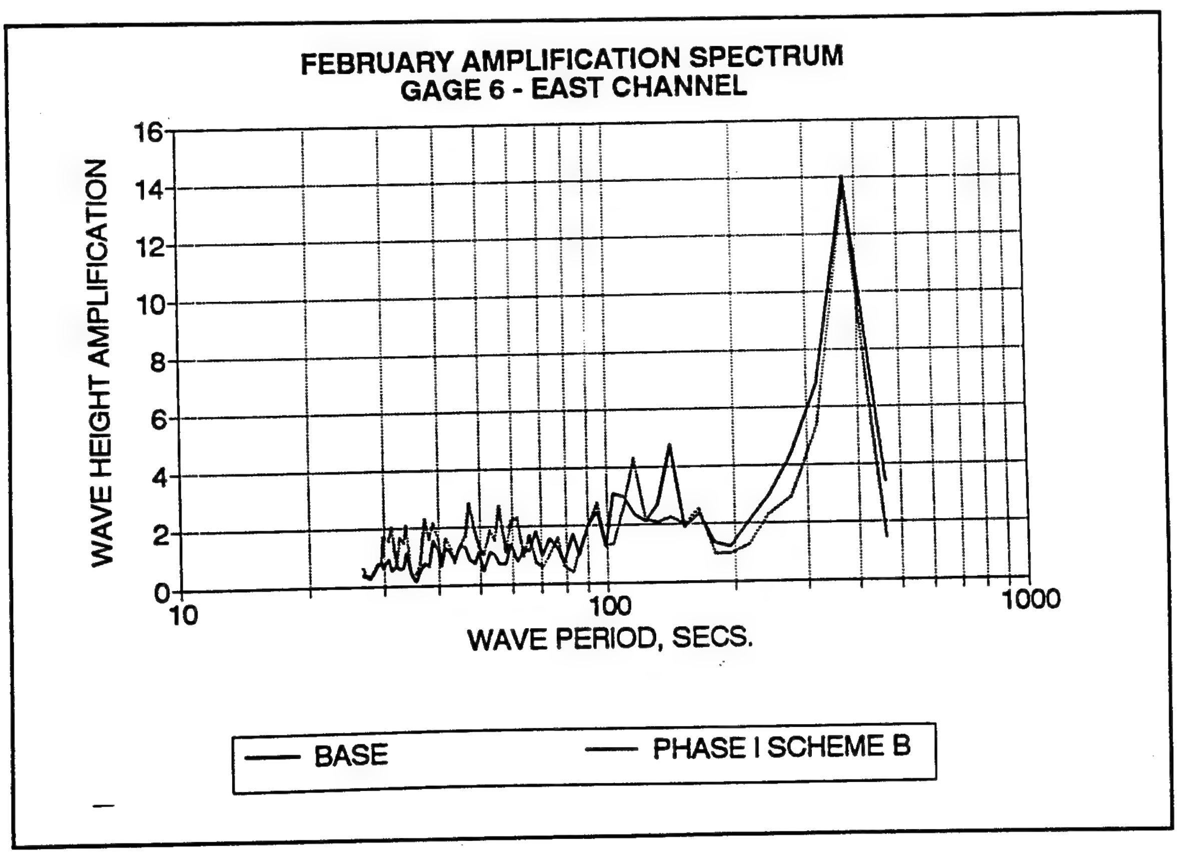

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 1 - LA WEST CHANNEL
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

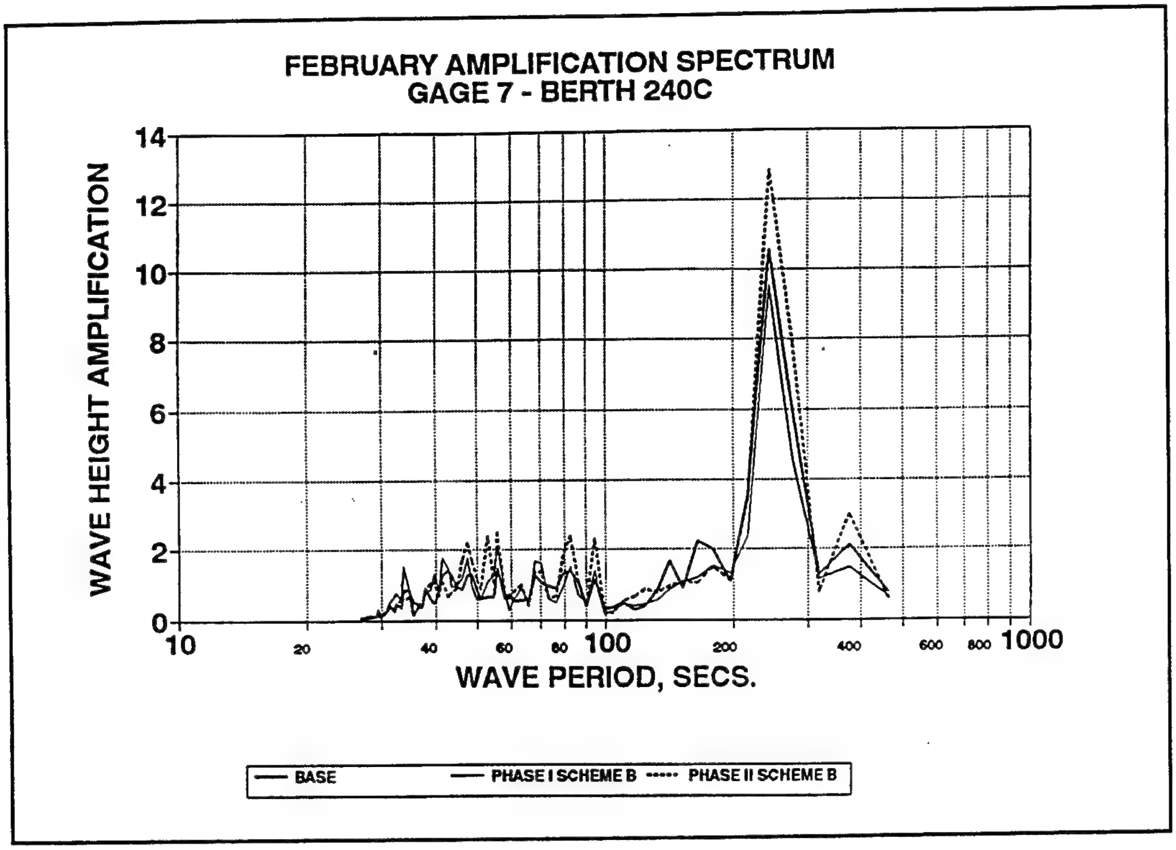

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 2 - LA WEST CH 5 ML BOAT BASIN
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

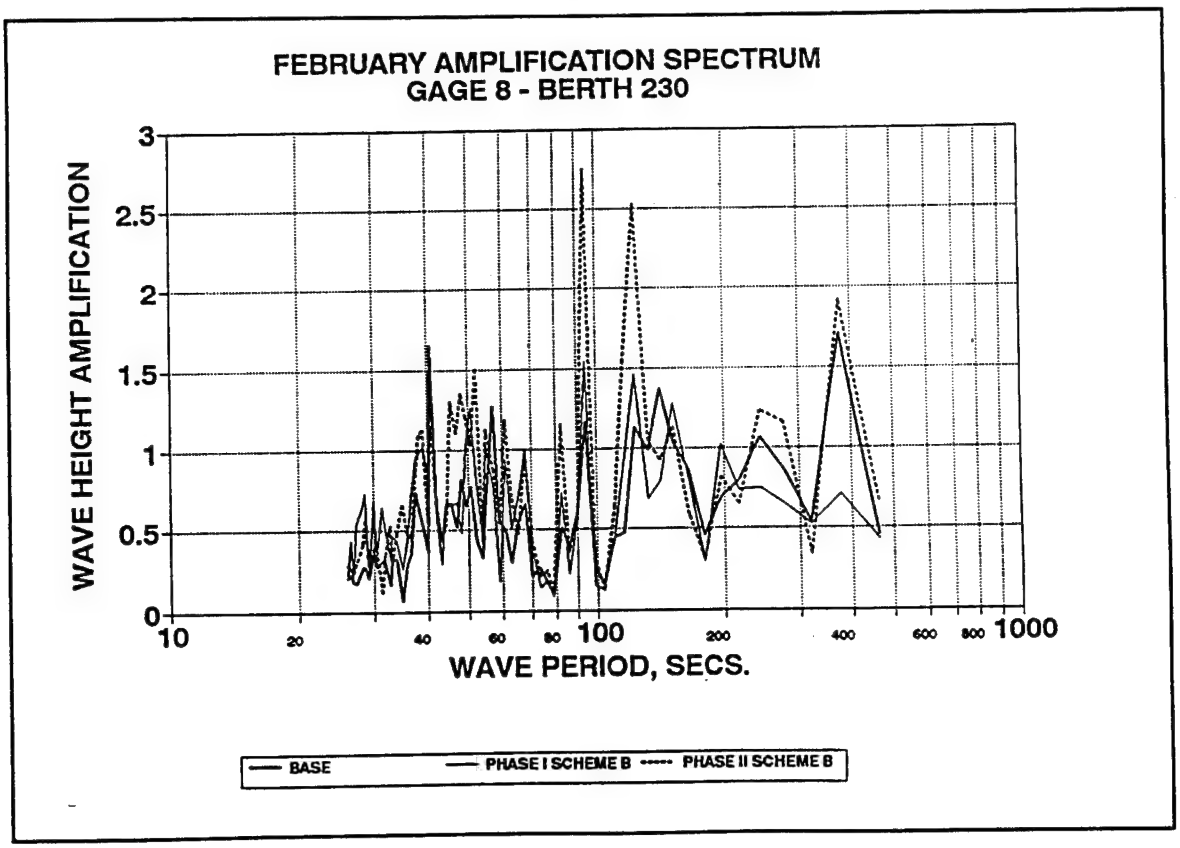

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 3 - WATCHORN BASIN
WAVE HEIGHT AMPLIFICATION
0
2
4
6
8
10
12
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

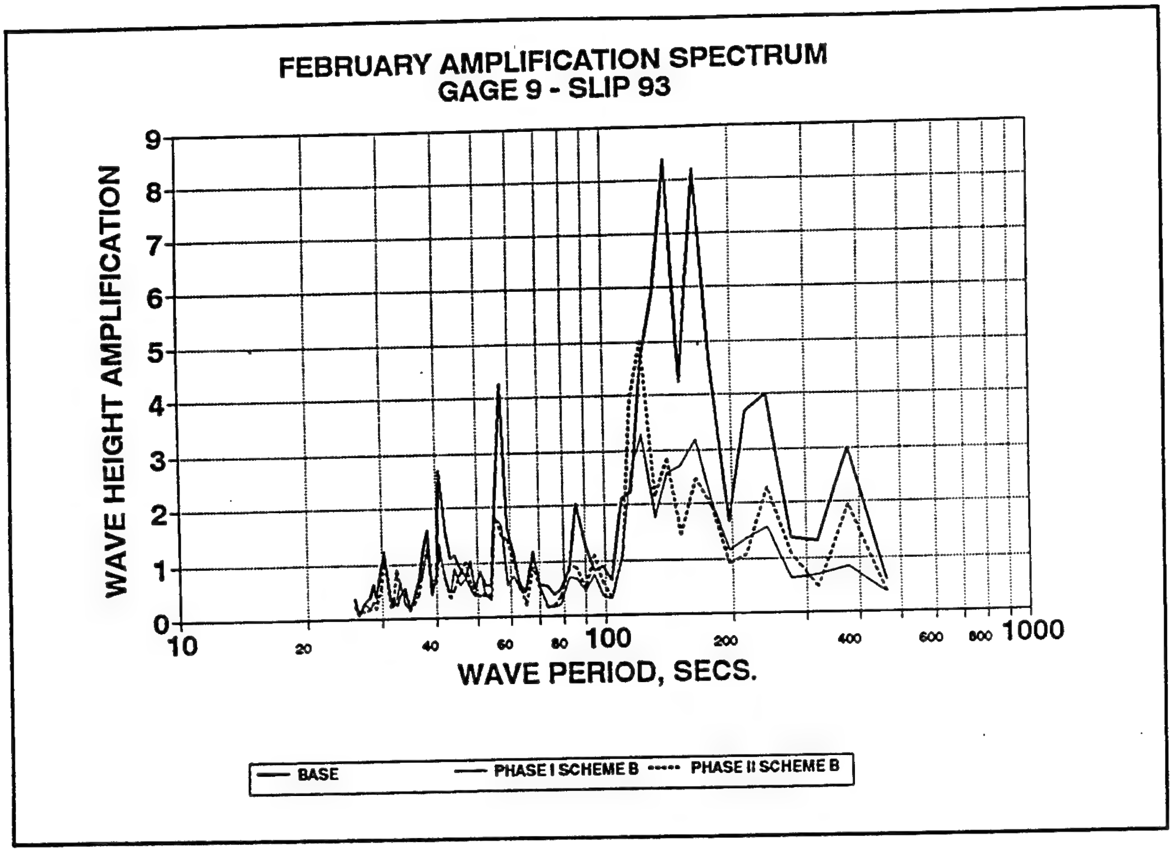

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 4 - LA BERTH 46
WAVE HEIGHT AMPLIFICATION
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

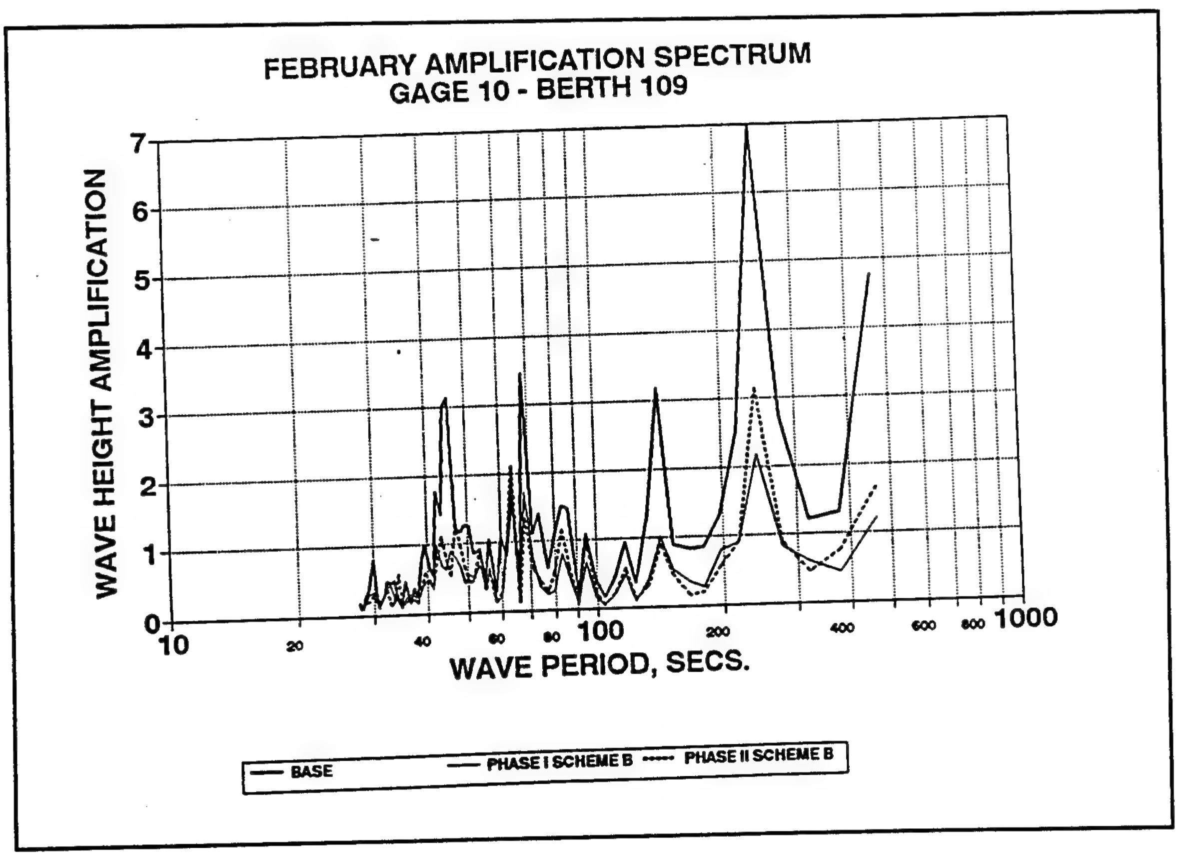

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 5 - LA COAL TERMINAL
WAVE HEIGHT AMPLIFICATION
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10
100
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B

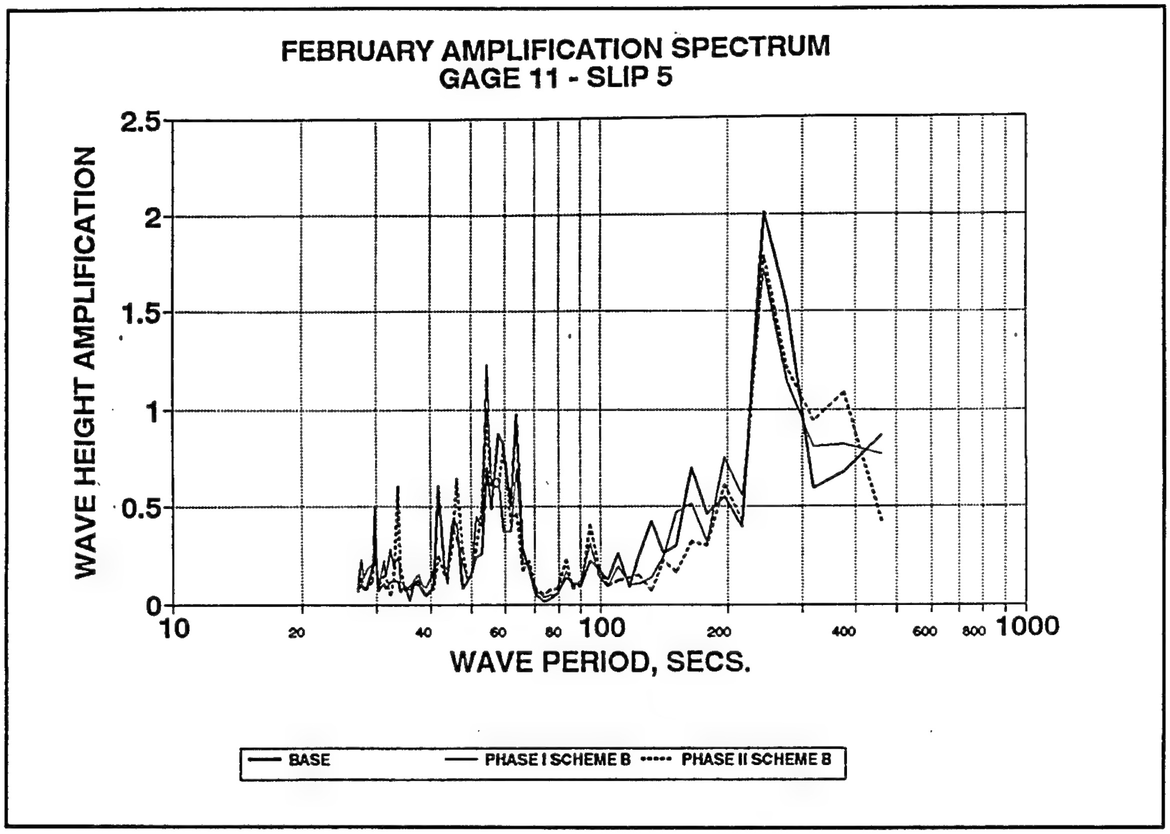

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 6 - EAST CHANNEL
WAVE HEIGHT AMPLIFICATION
16
14
12
10
8
6
4
2
0
10
100
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B

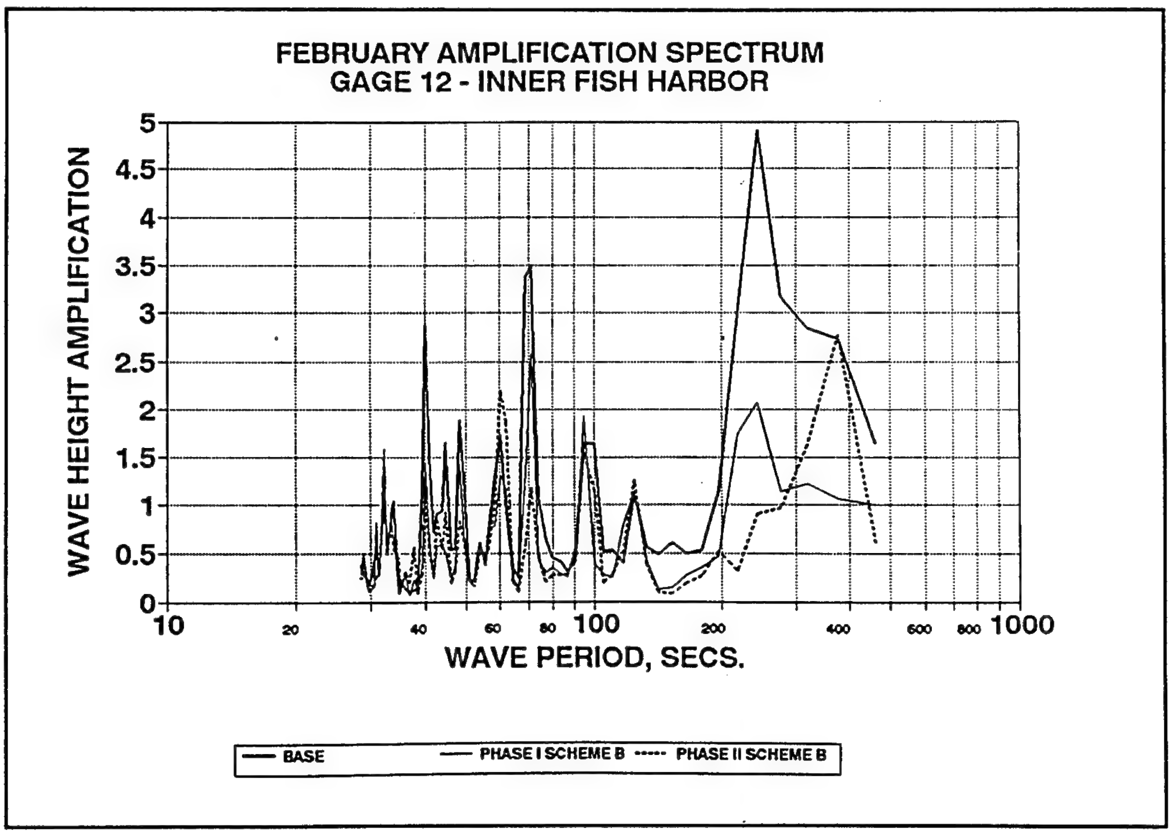

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 7 - BERTH 240C
WAVE HEIGHT AMPLIFICATION
0
2
4
6
8
10
12
14
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

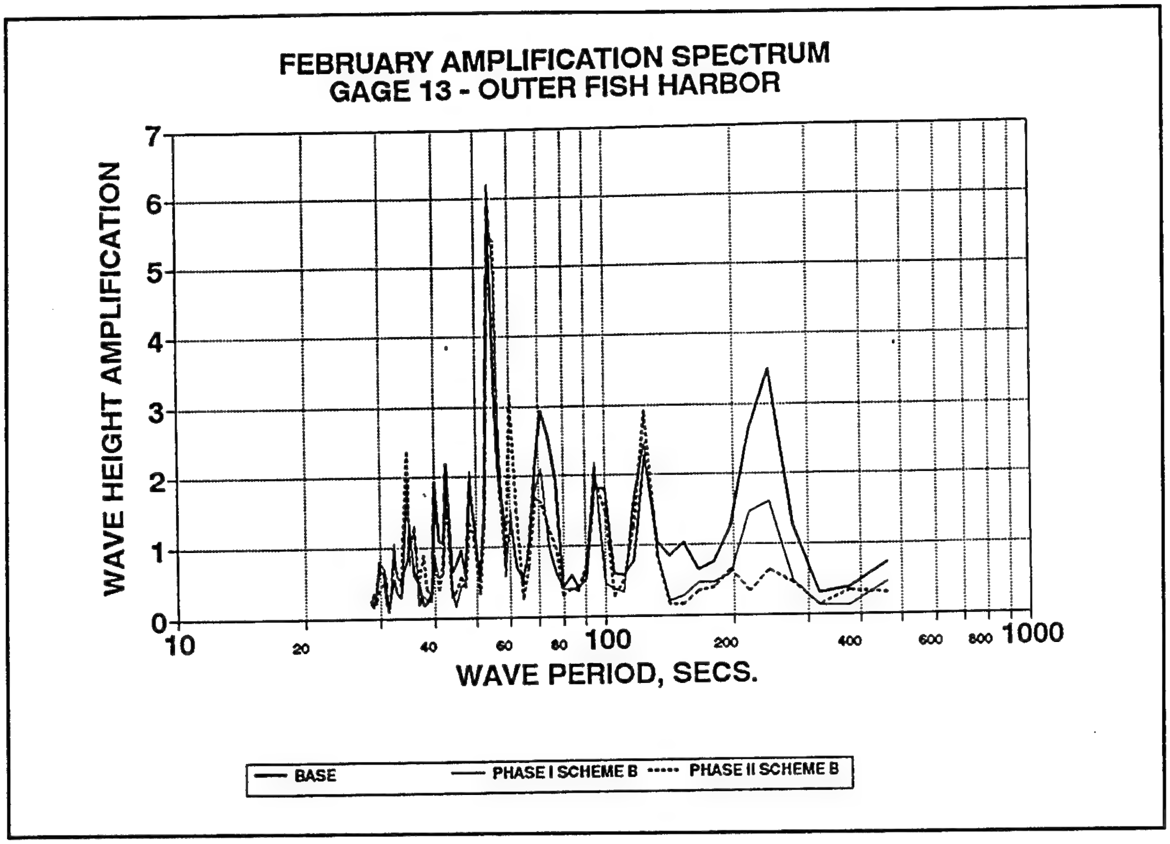

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 8 - BERTH 230
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

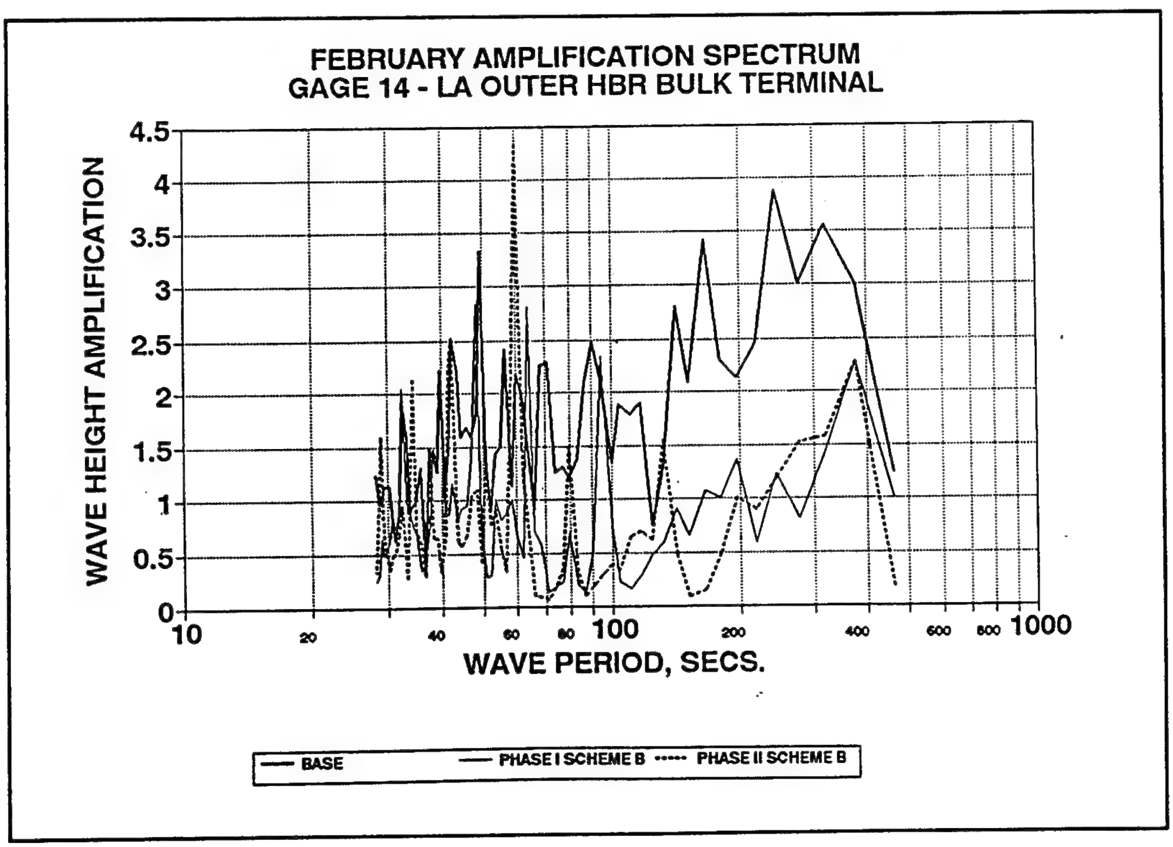

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 9 - SLIP 93
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

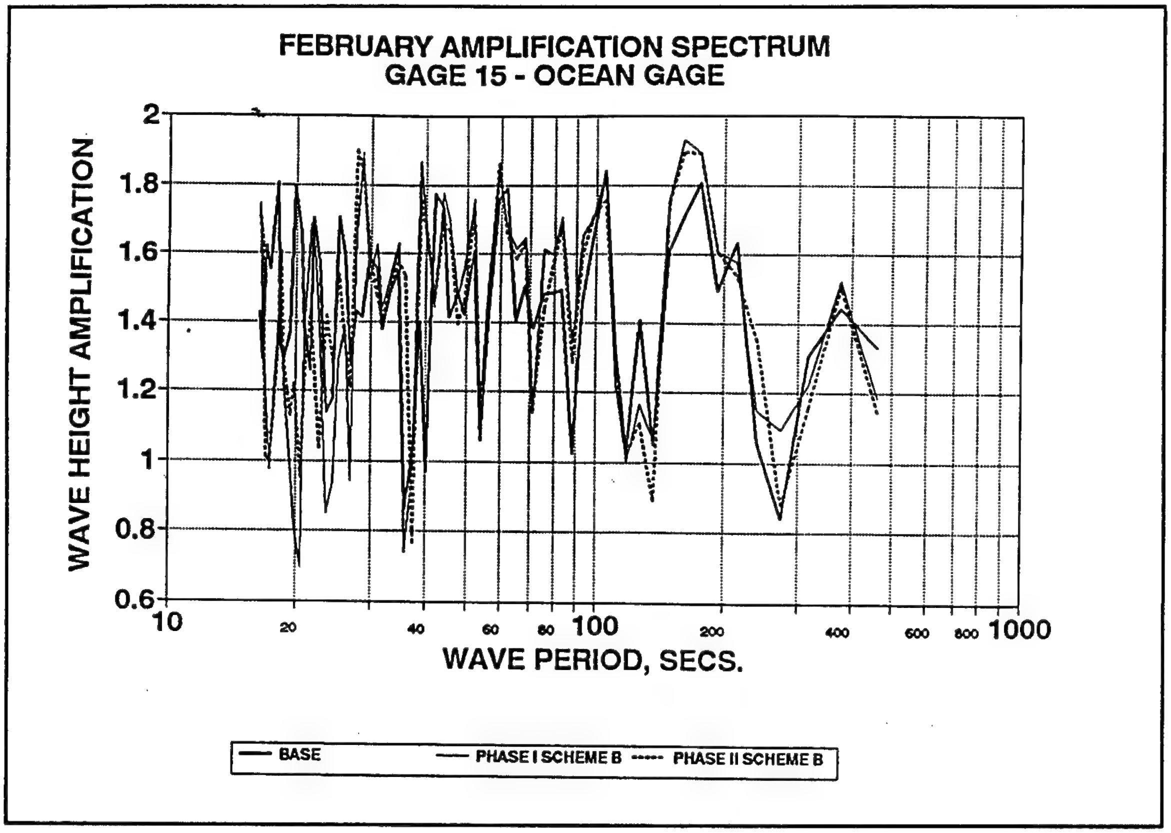

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 10 - BERTH 109
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

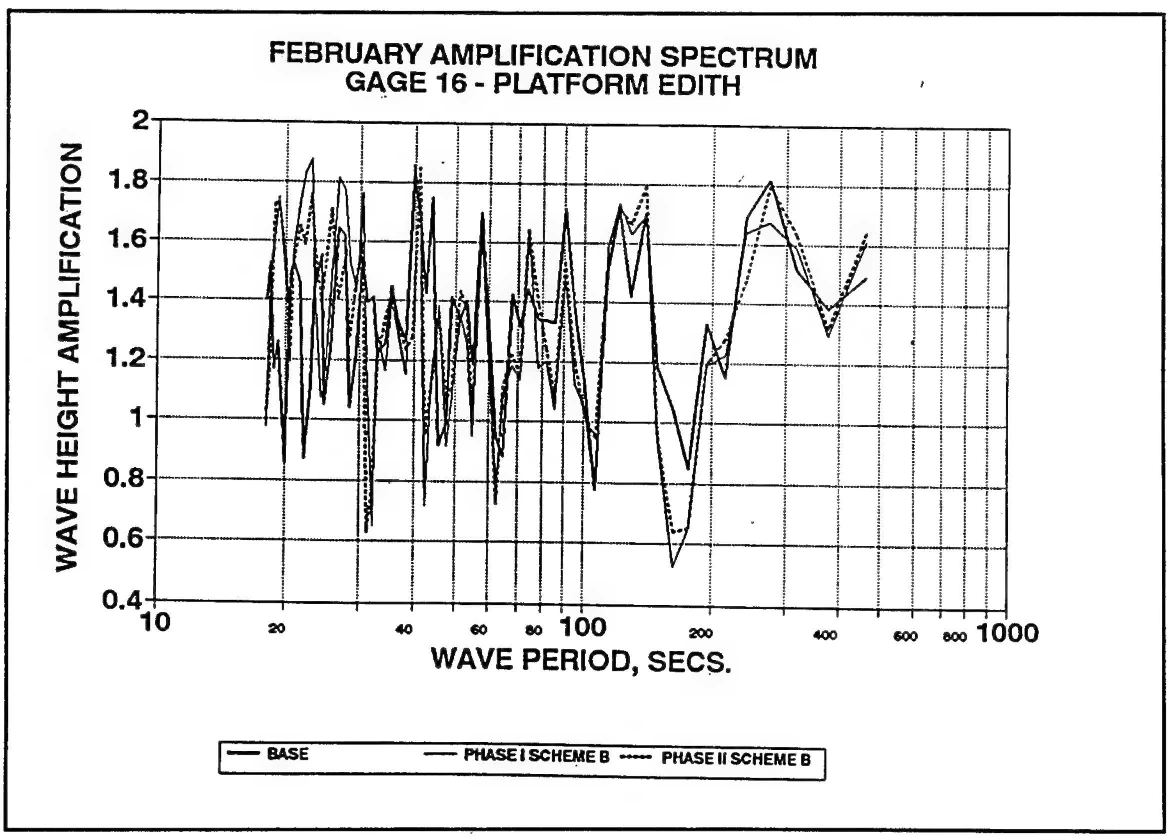

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 11 - SLIP 5
WAVE HEIGHT AMPLIFICATION
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

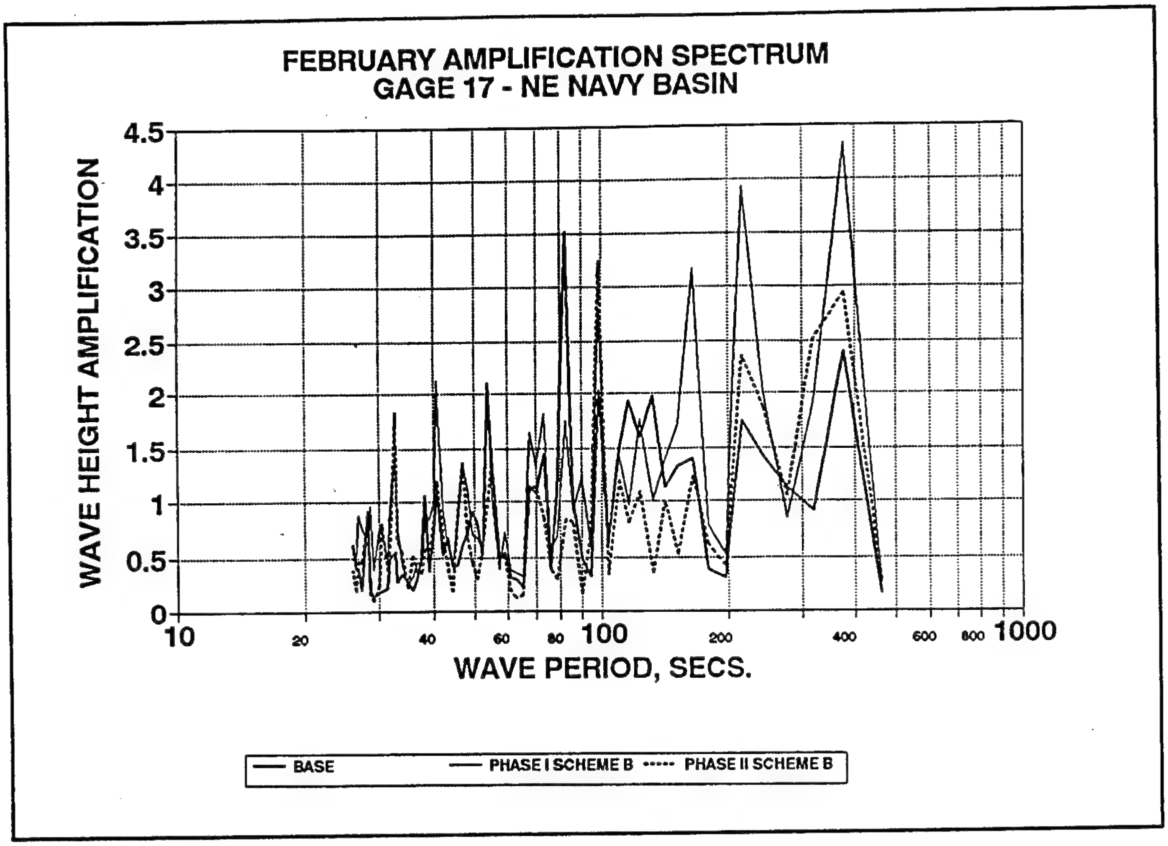

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 12 - INNER FISH HARBOR
WAVE HEIGHT AMPLIFICATION
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B


FEBRUARY AMPLIFICATION SPECTRUM
GAGE 13 - OUTER FISH HARBOR
WAVE HEIGHT AMPLIFICATION
7
6
5
4
3
2
1
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

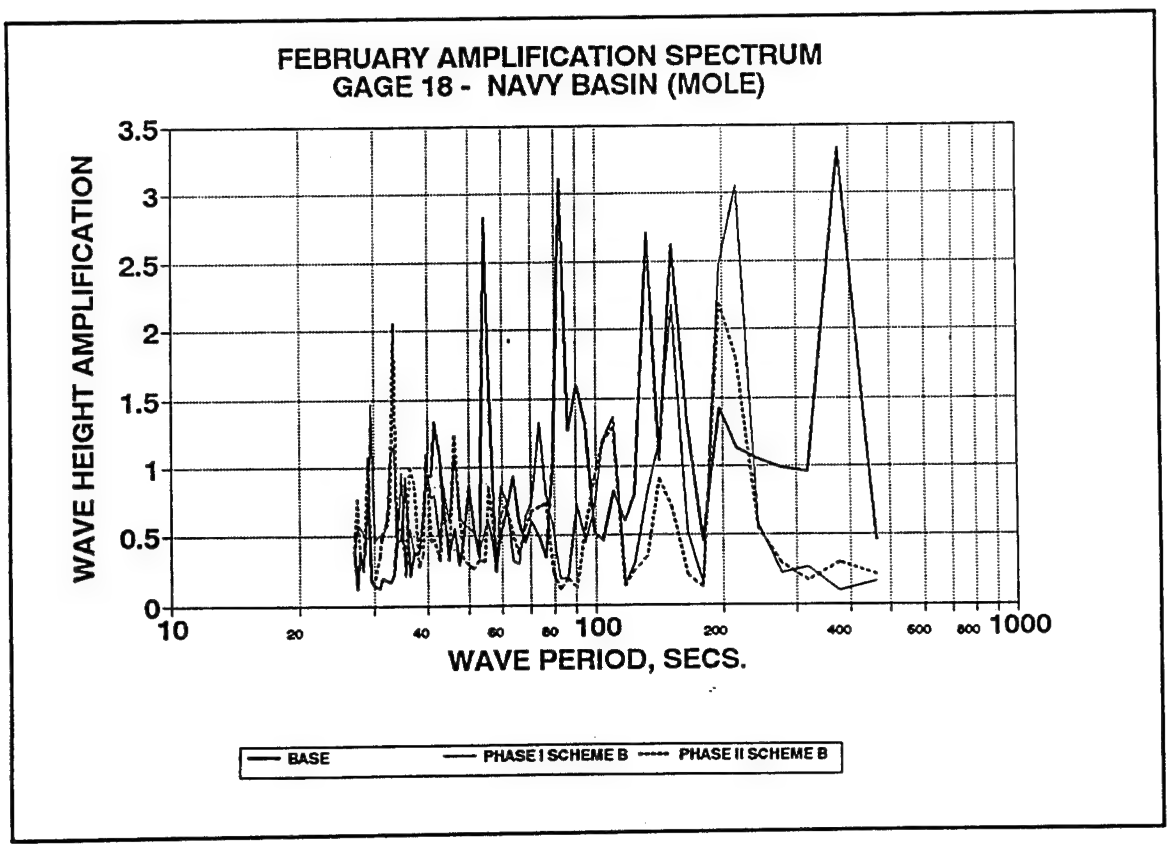

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 14 - LA OUTER HBR BULK TERMINAL
WAVE HEIGHT AMPLIFICATION
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B


FEBRUARY AMPLIFICATION SPECTRUM
GAGE 15 - OCEAN GAGE
WAVE HEIGHT AMPLIFICATION
2
1.8
1.6
1.4
1.2
1
0.8
0.6
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

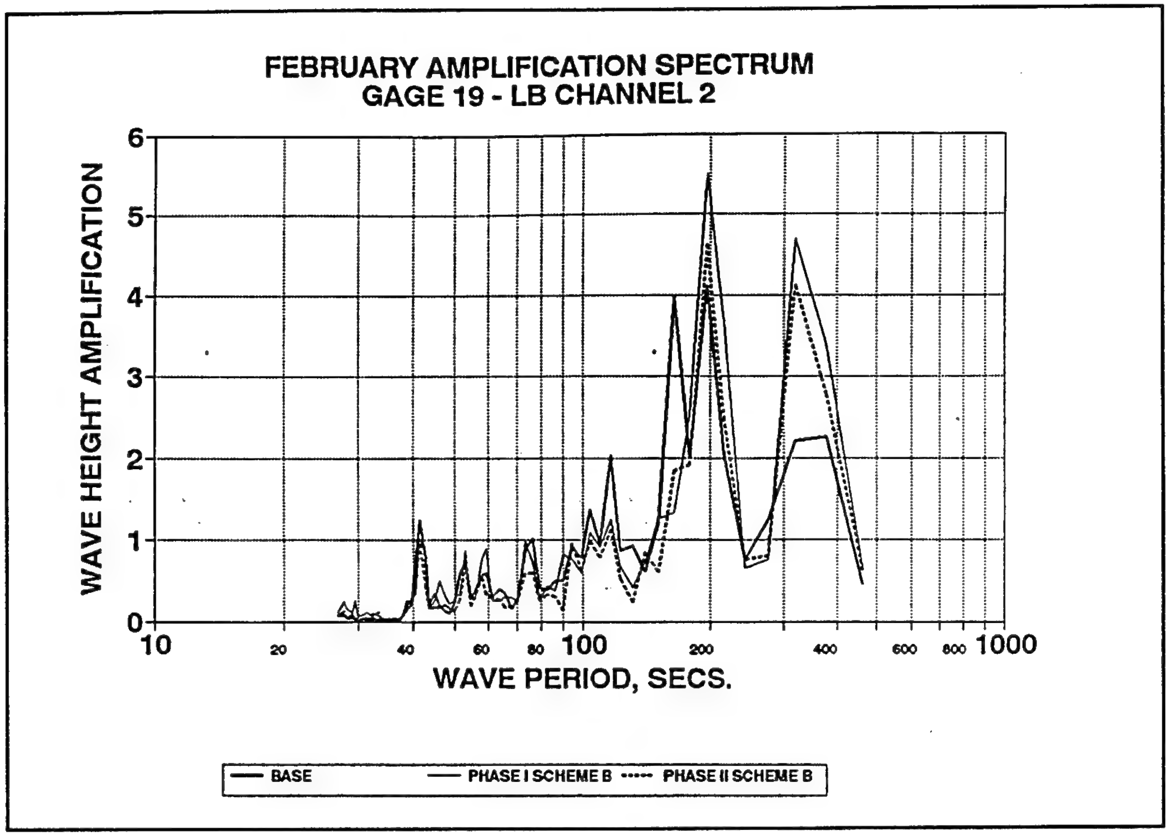

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 16 - PLATFORM EDITH
WAVE HEIGHT AMPLIFICATION
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

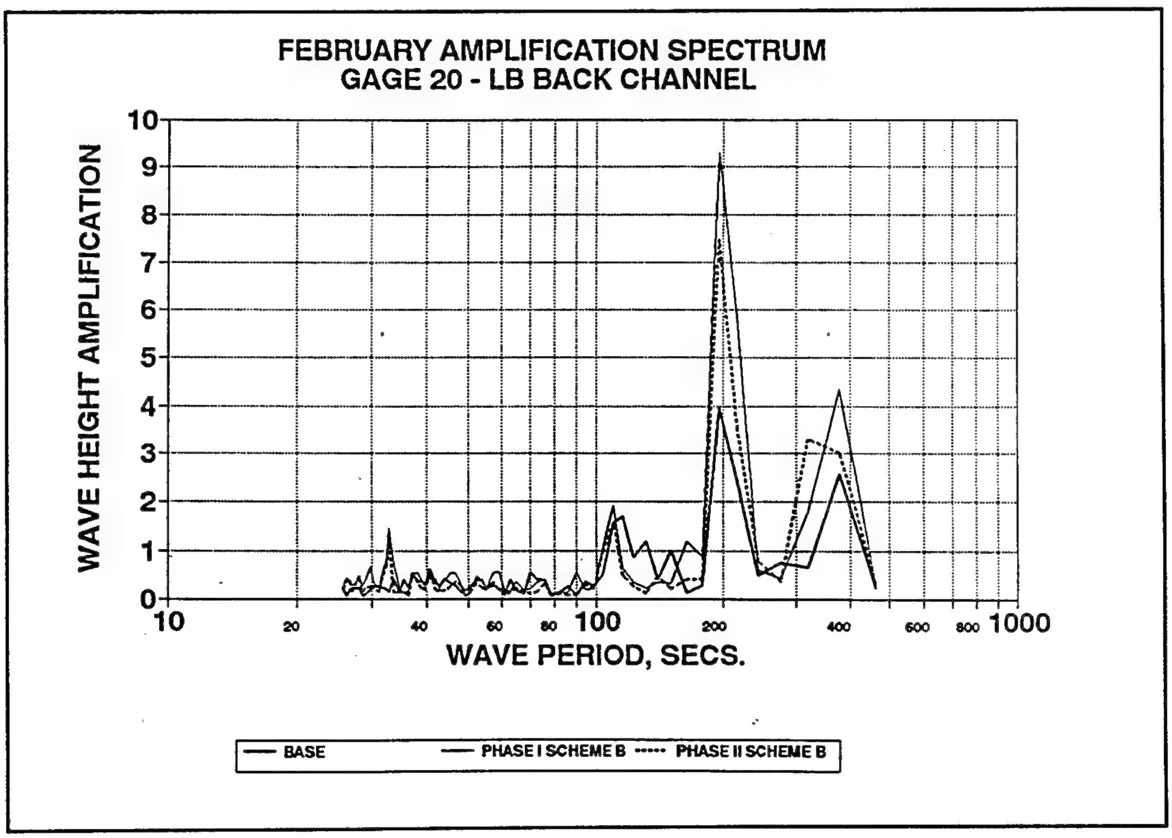


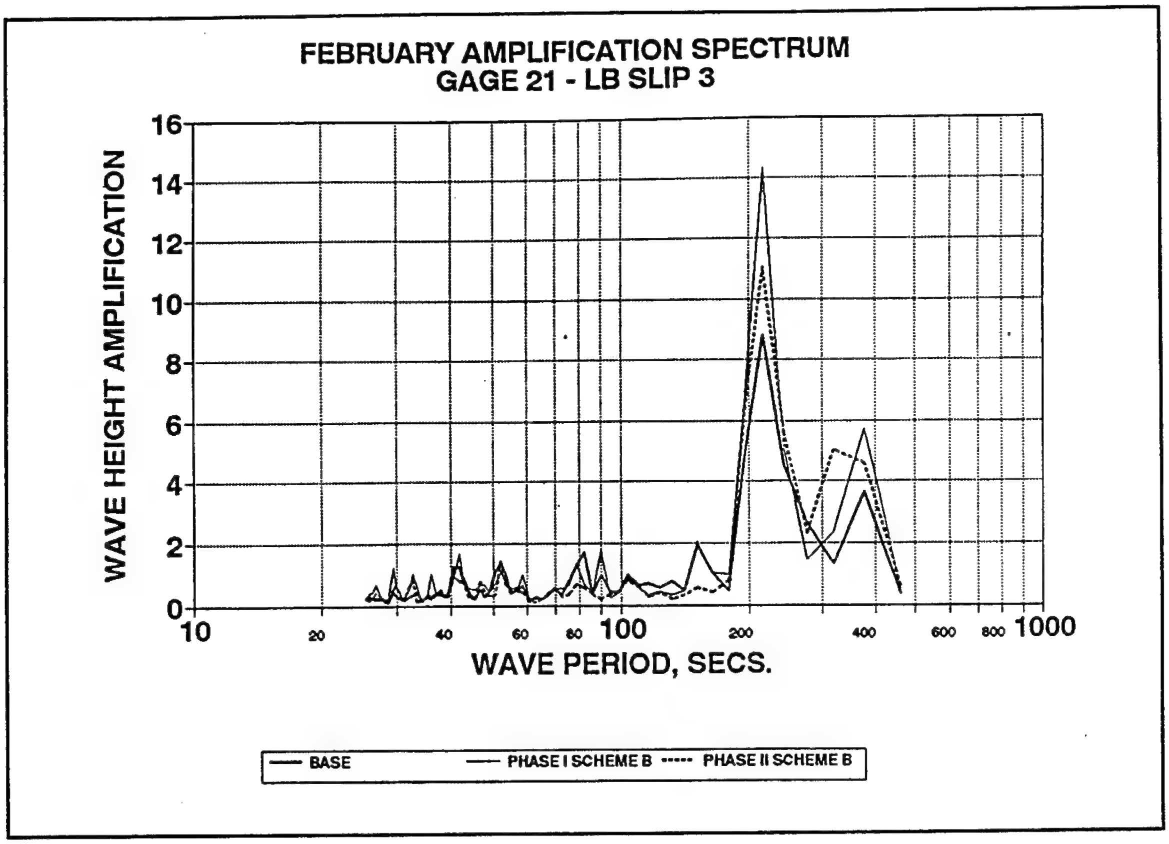
FEBRUARY AMPLIFICATION SPECTRUM
GAGE 17 - NE NAVY BASIN
WAVE HEIGHT AMPLIFICATION
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

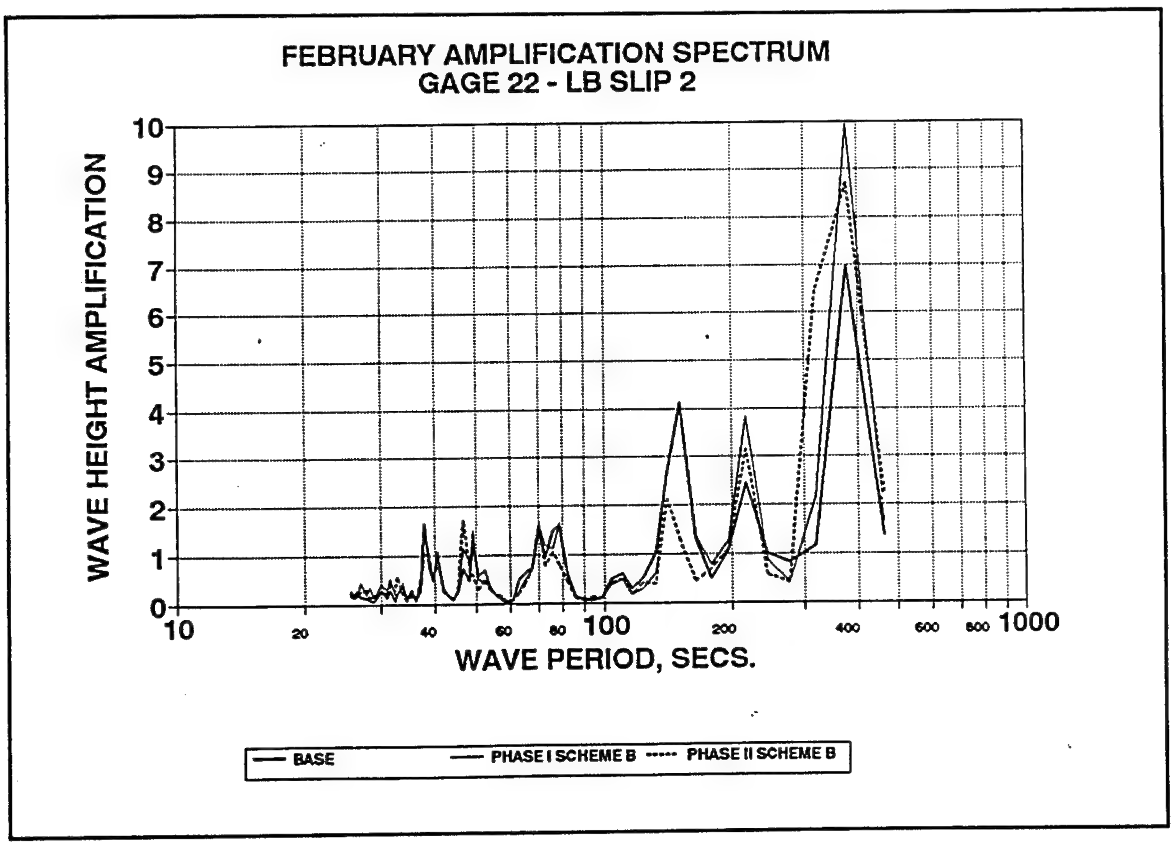



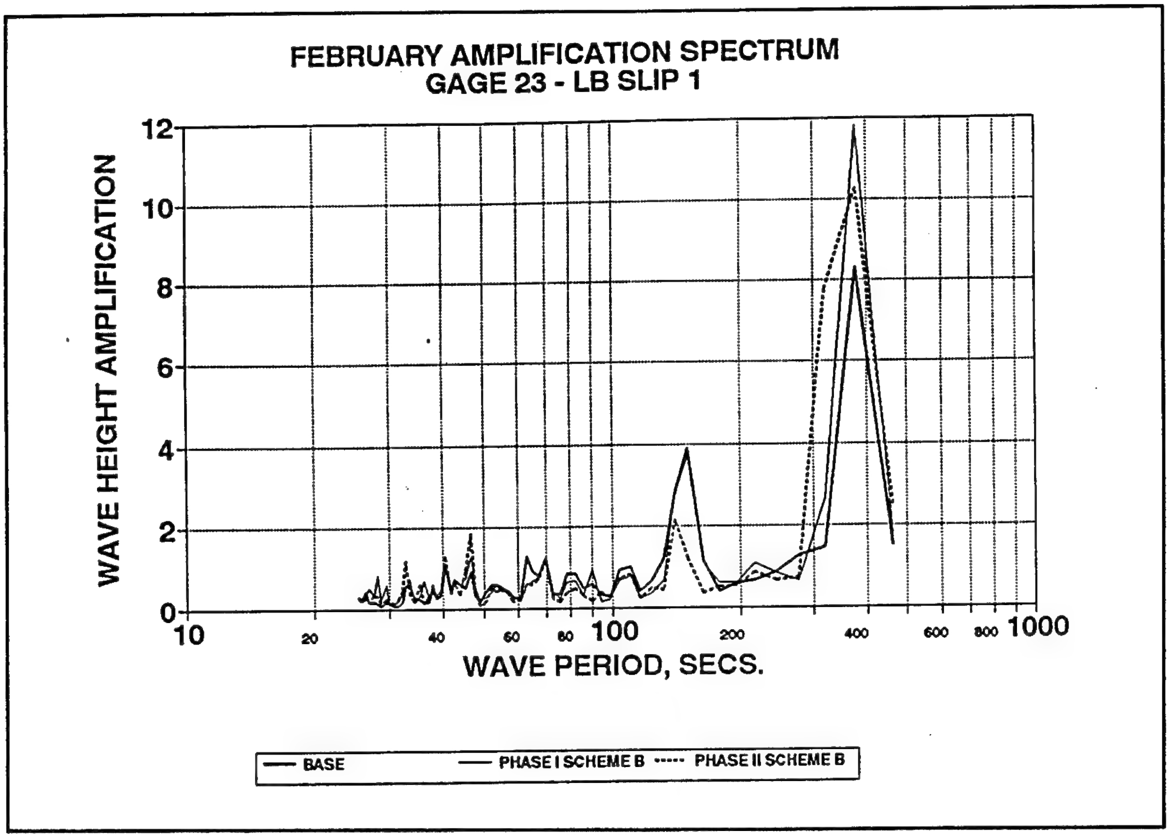
FEBRUARY AMPLIFICATION SPECTRUM
GAGE 18 - NAVY BASIN (MOLE)
WAVE HEIGHT AMPLIFICATION
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

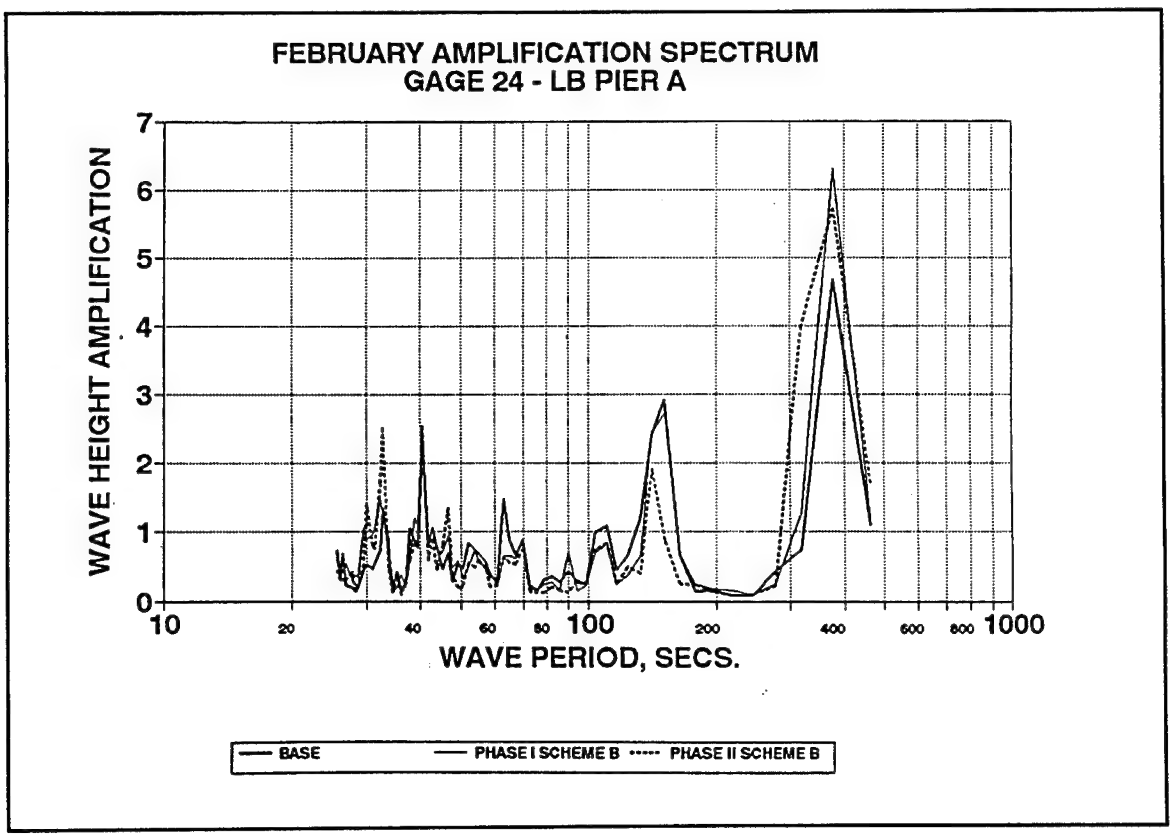

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 19 - LB CHANNEL 2
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

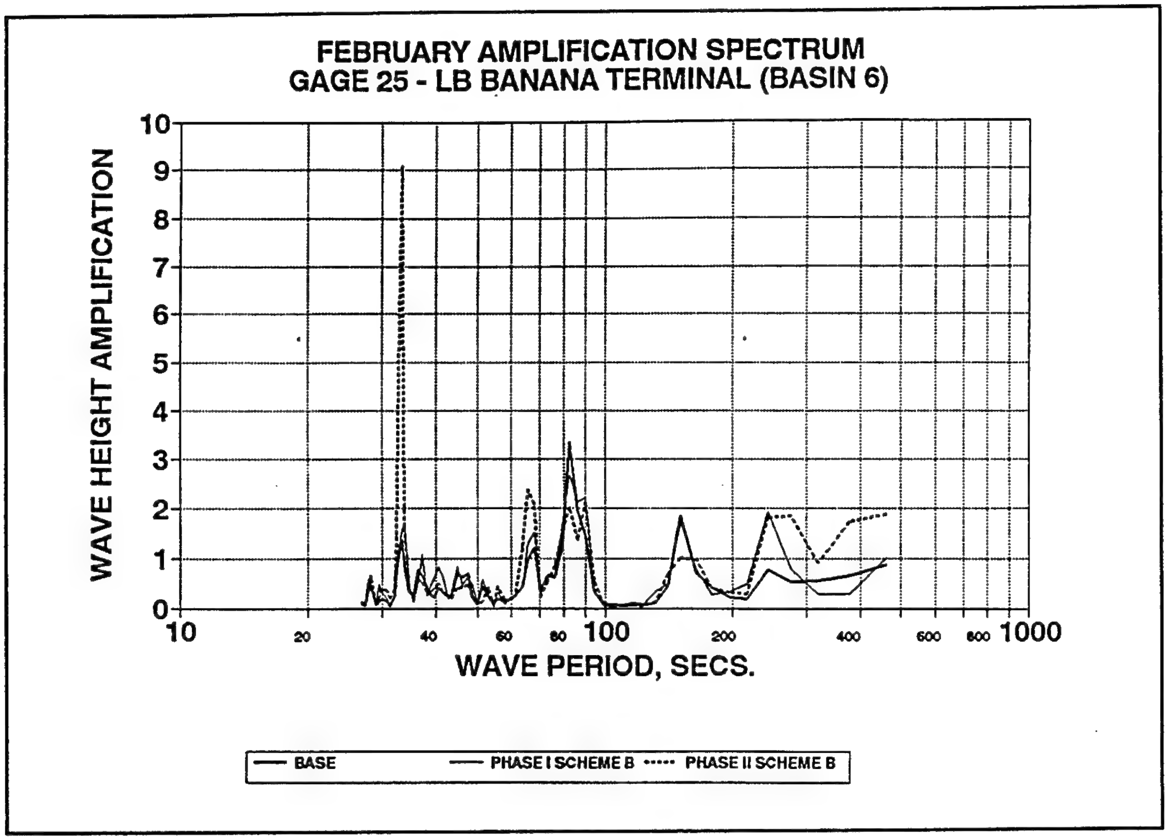

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 20 - LB BACK CHANNEL
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
7
8
9
10
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

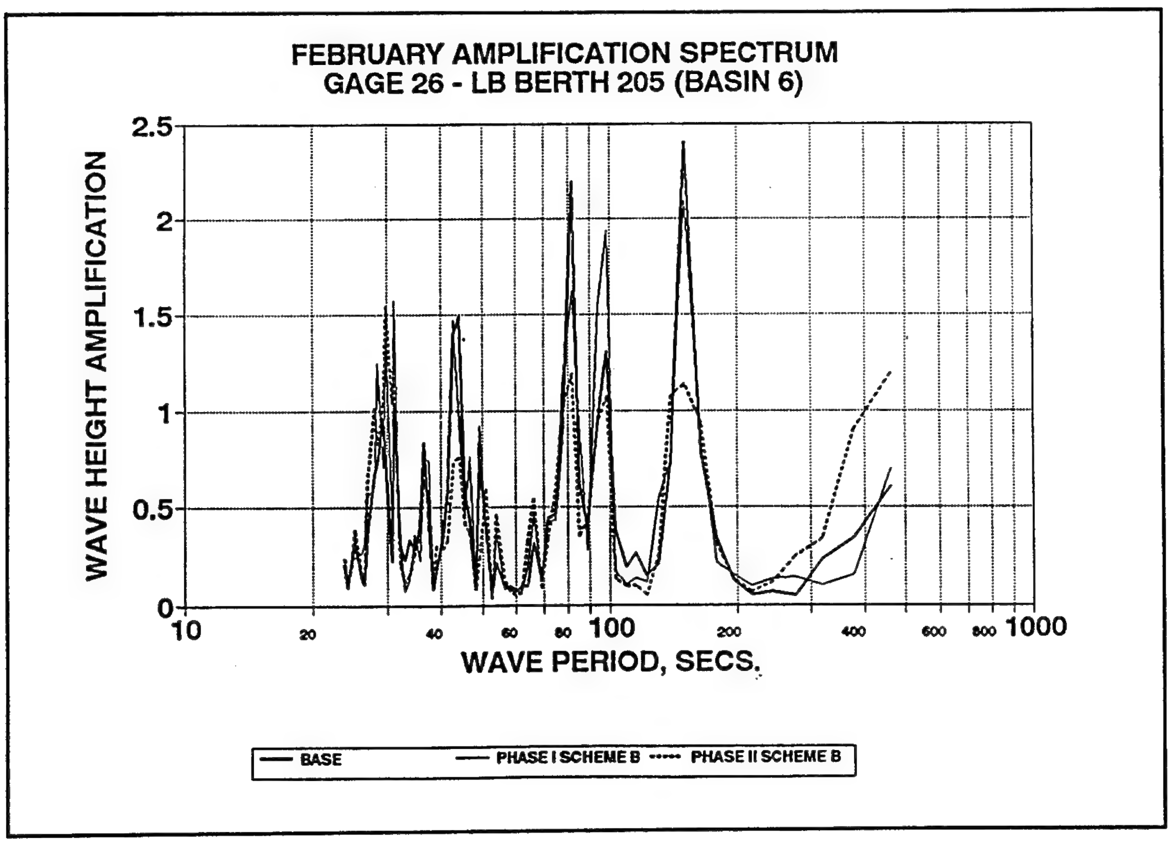

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 21 - LB SLIP 3
WAVE HEIGHT AMPLIFICATION
0
2
4
6
8
10
12
14
16
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

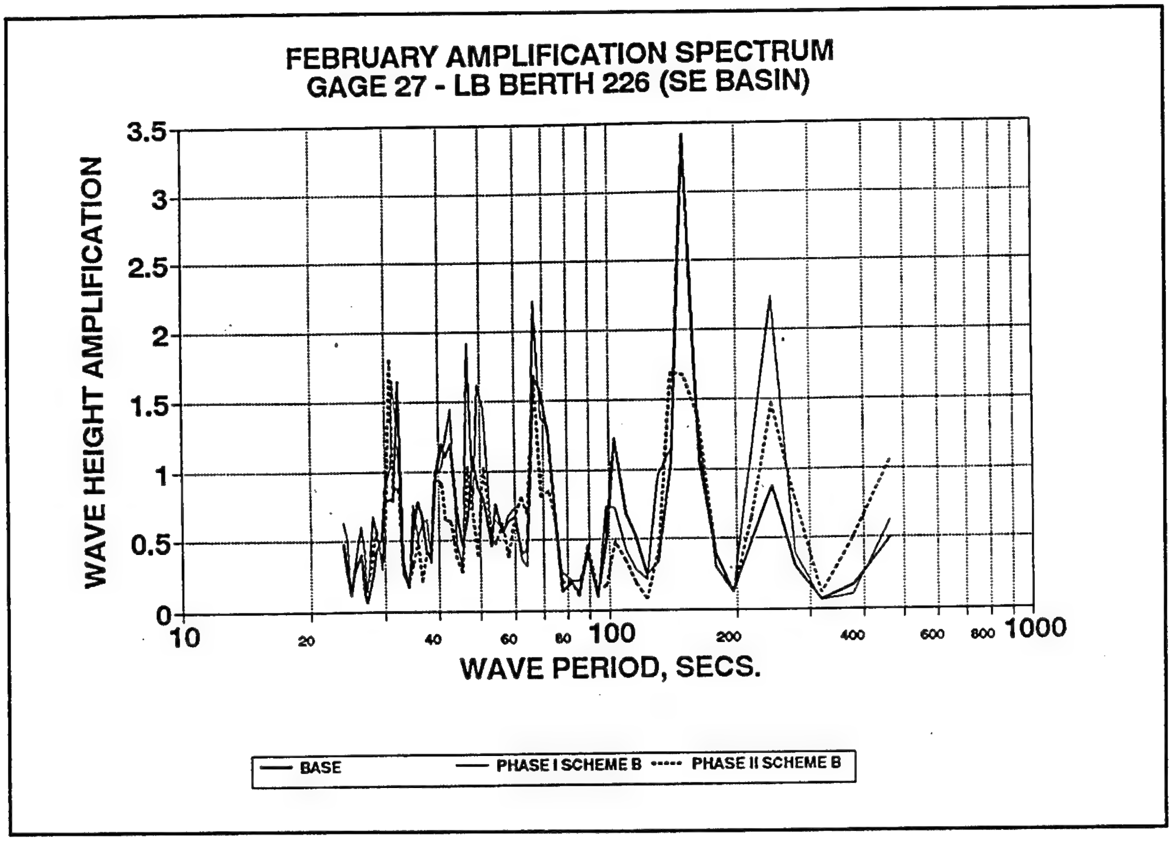

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 22 - LB SLIP 2
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
7
8
9
10
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

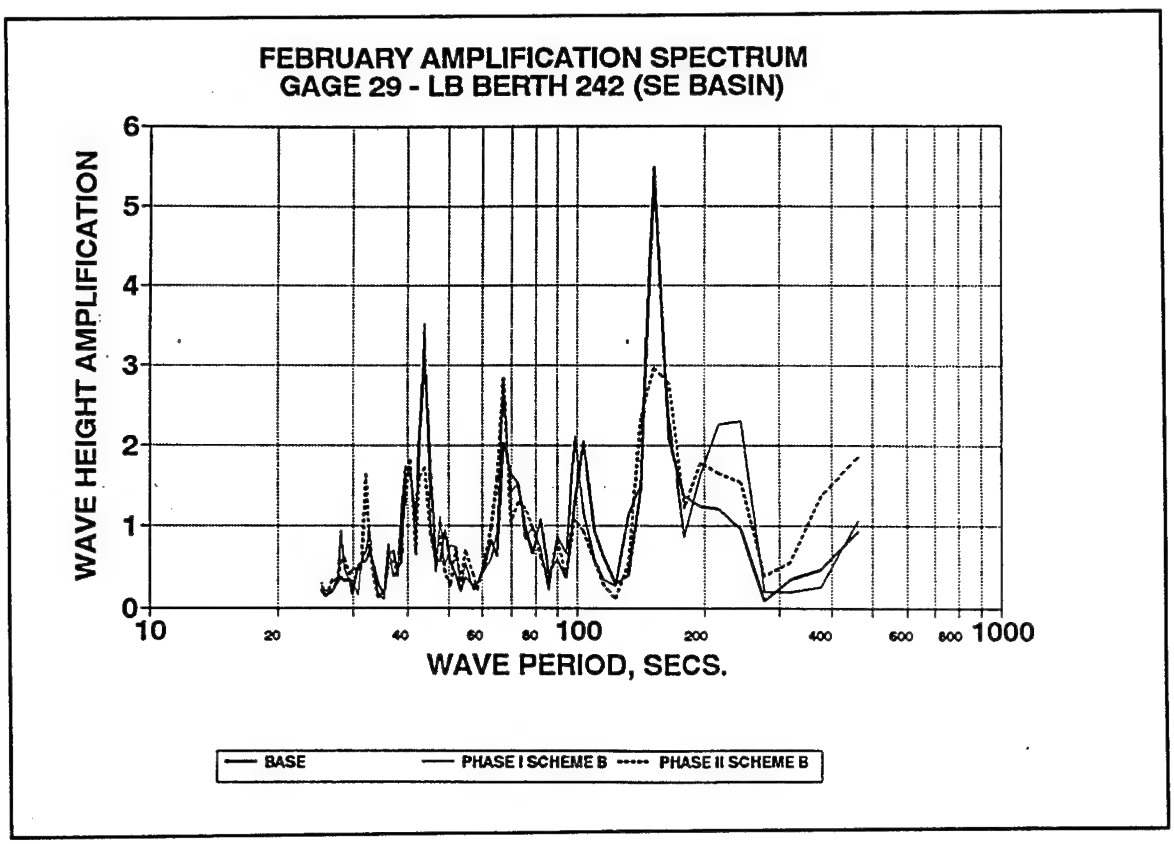

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 23 - LB SLIP 1
WAVE HEIGHT AMPLIFICATION
0
2
4
6
8
10
12
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

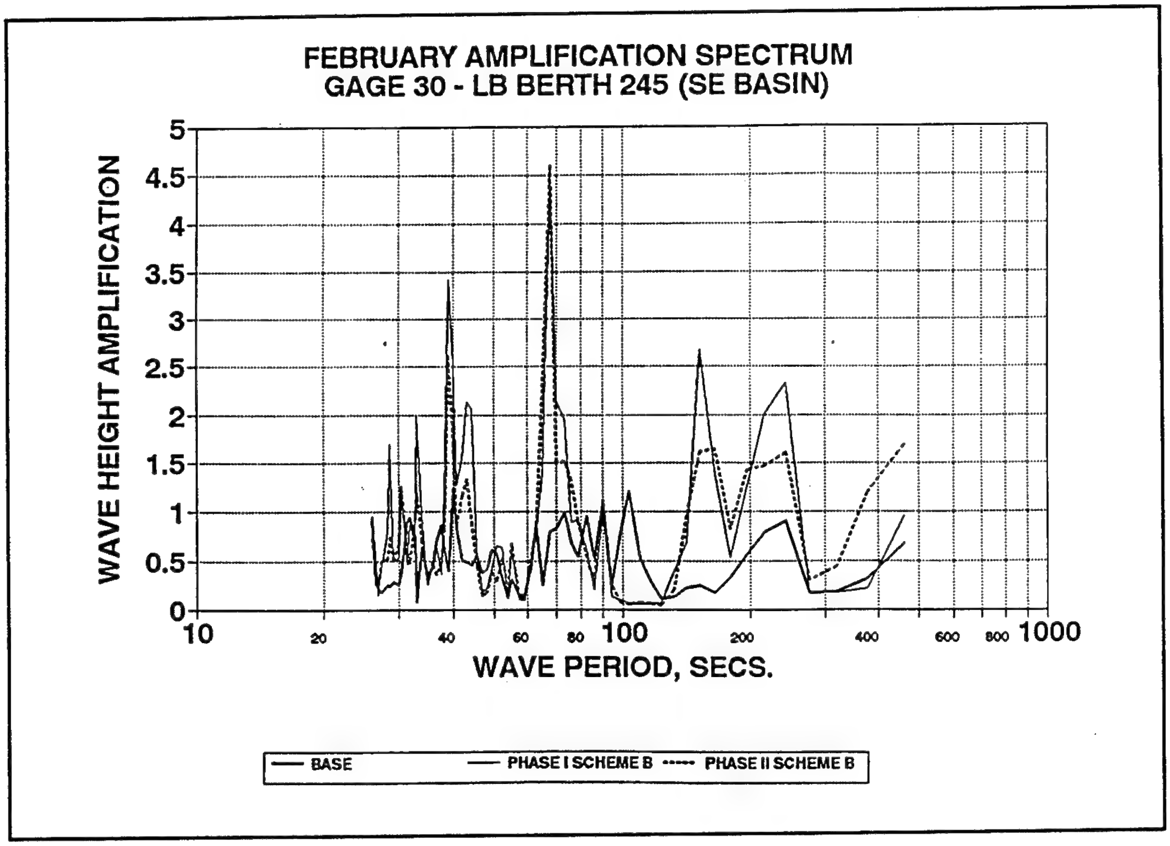

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 24 - LB PIER A
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
7
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

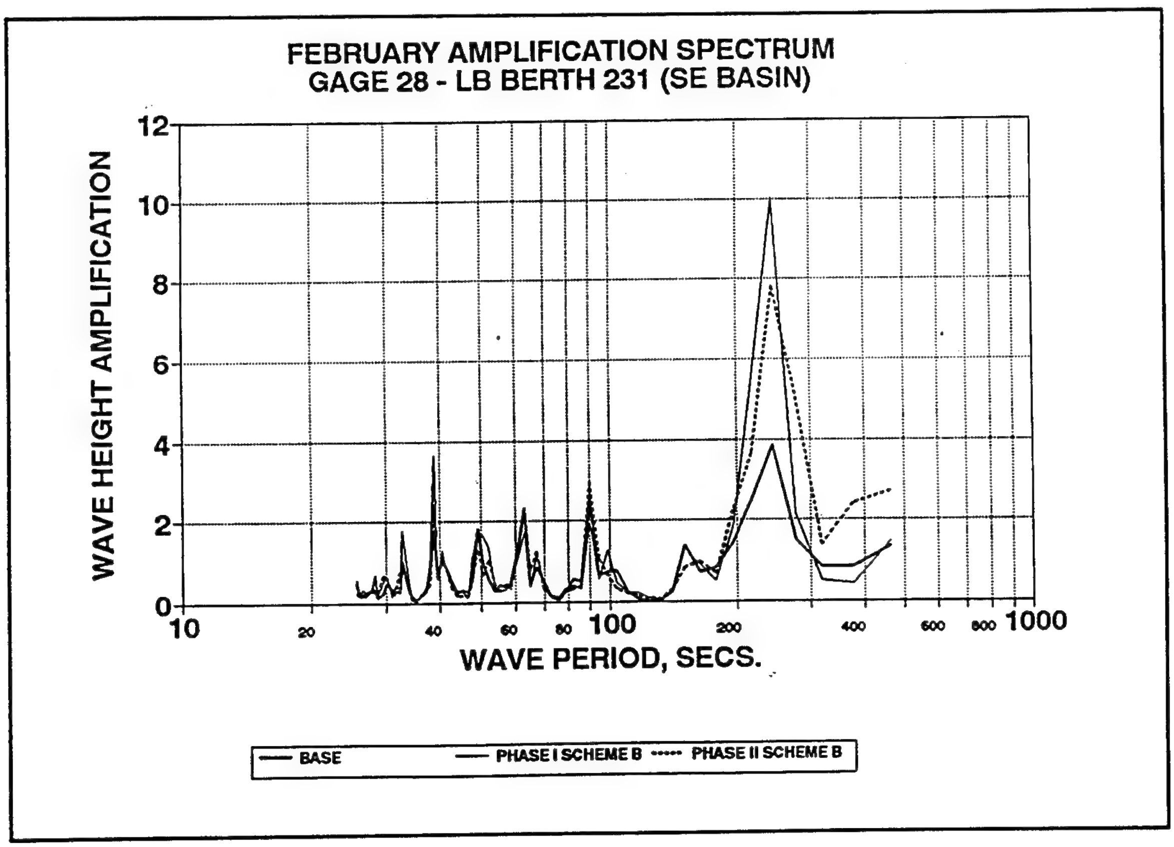

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 25 - LB BANANA TERMINAL (BASIN 6)
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

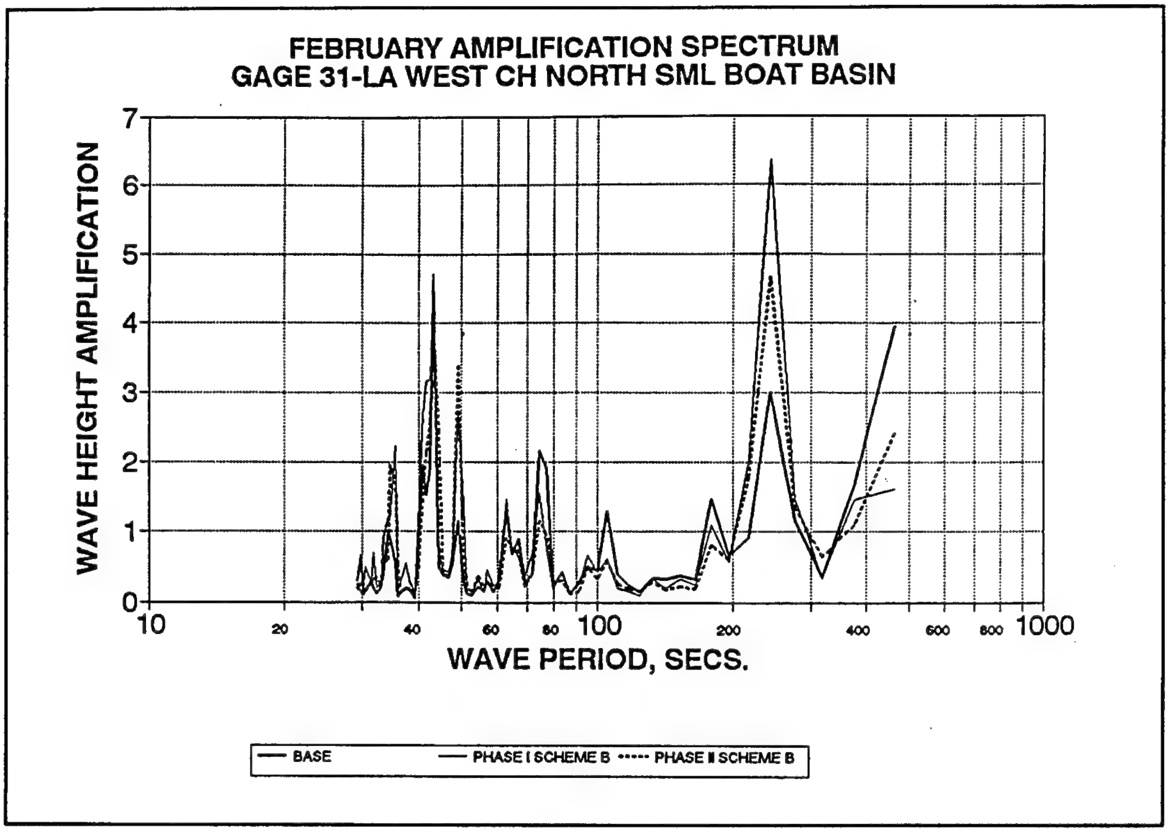

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 26 - LB BERTH 205 (BASIN 6)
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B


FEBRUARY AMPLIFICATION SPECTRUM
GAGE 27 - LB BERTH 226 (SE BASIN)
WAVE HEIGHT AMPLIFICATION
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

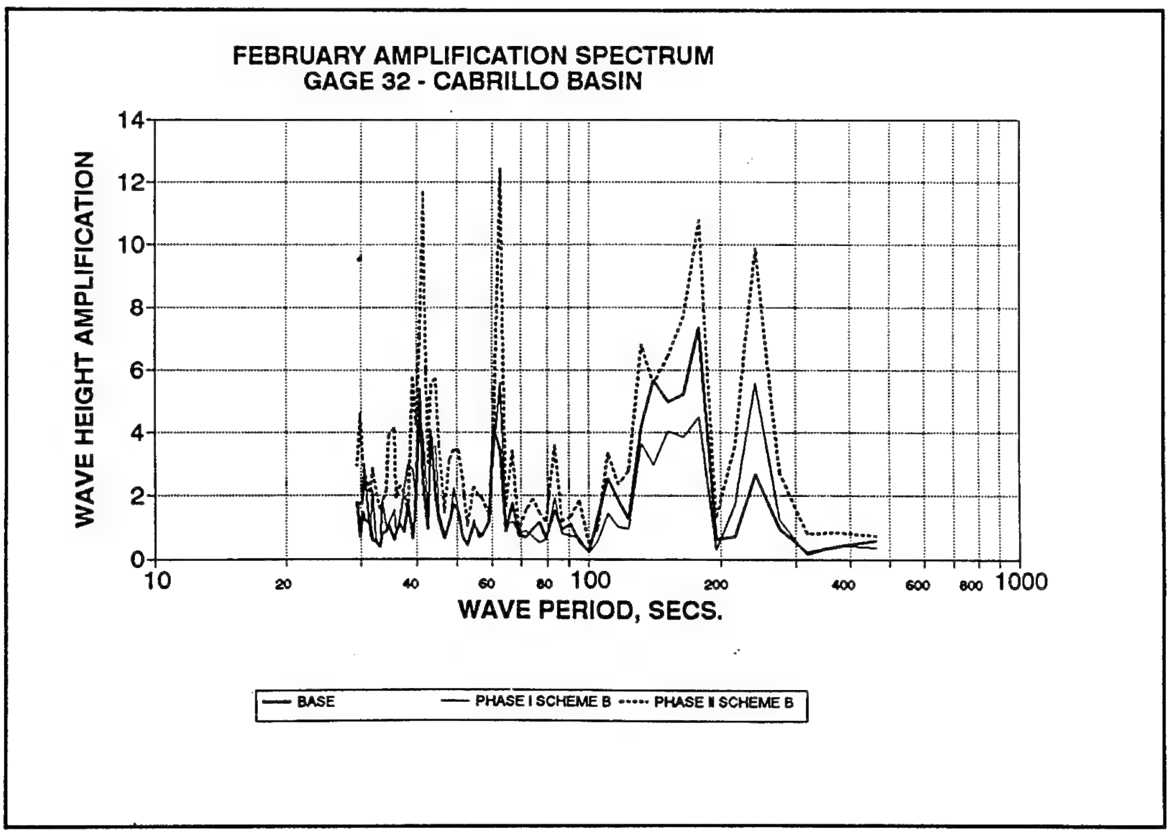

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 29 - LB BERTH 242 (SE BASIN)
WAVE HEIGHT AMPLIFICATION
6
5
4
3
2
1
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B


FEBRUARY AMPLIFICATION SPECTRUM
GAGE 30 - LB BERTH 245 (SE BASIN)
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

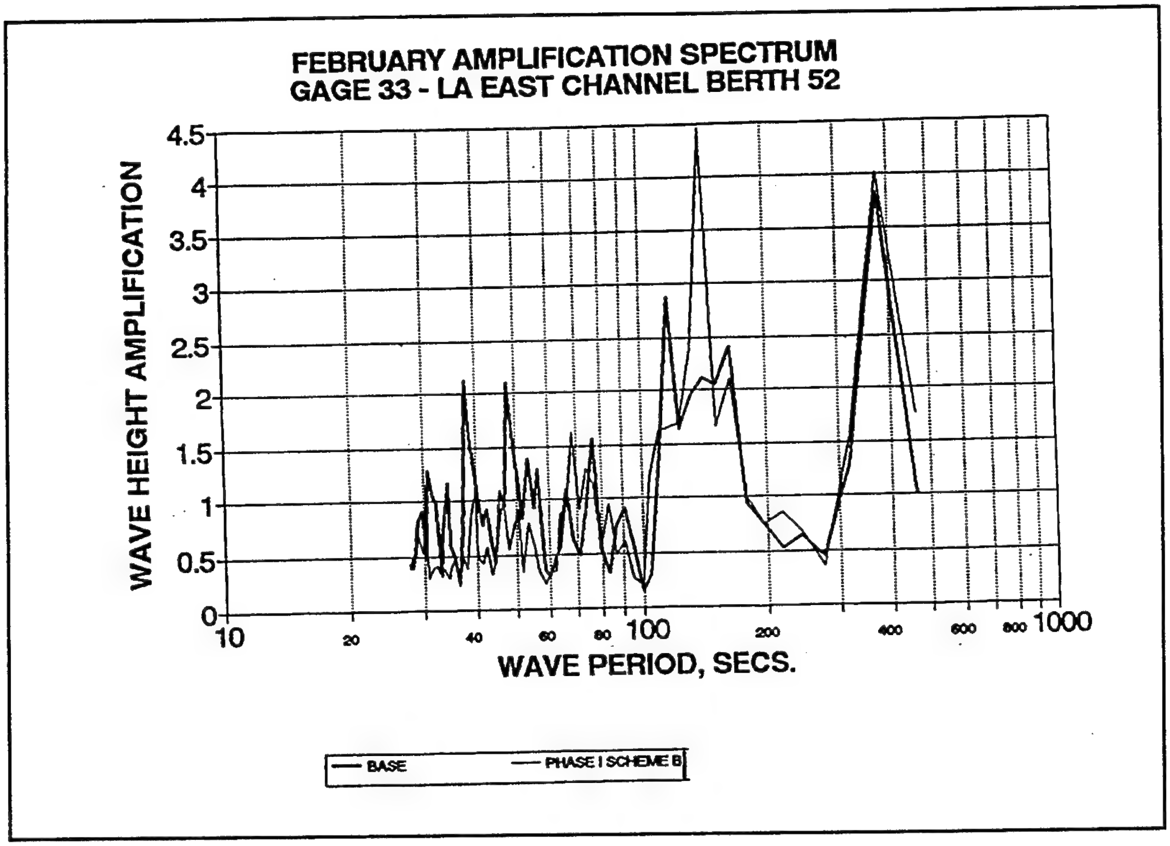

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 28 - LB BERTH 231 (SE BASIN)
WAVE HEIGHT AMPLIFICATION
0
2
4
6
8
10
12
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B



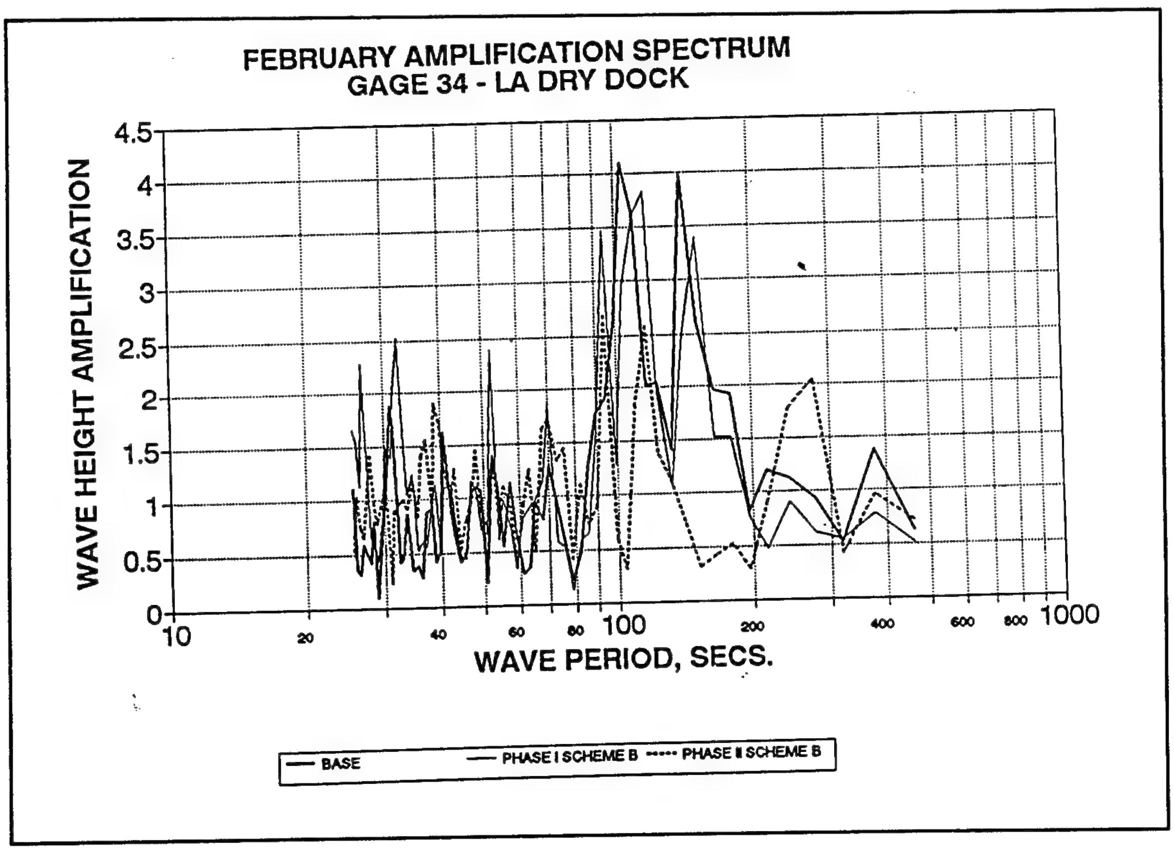
FEBRUARY AMPLIFICATION SPECTRUM
GAGE 31-LA WEST CH NORTH SML BOAT BASIN
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
7
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

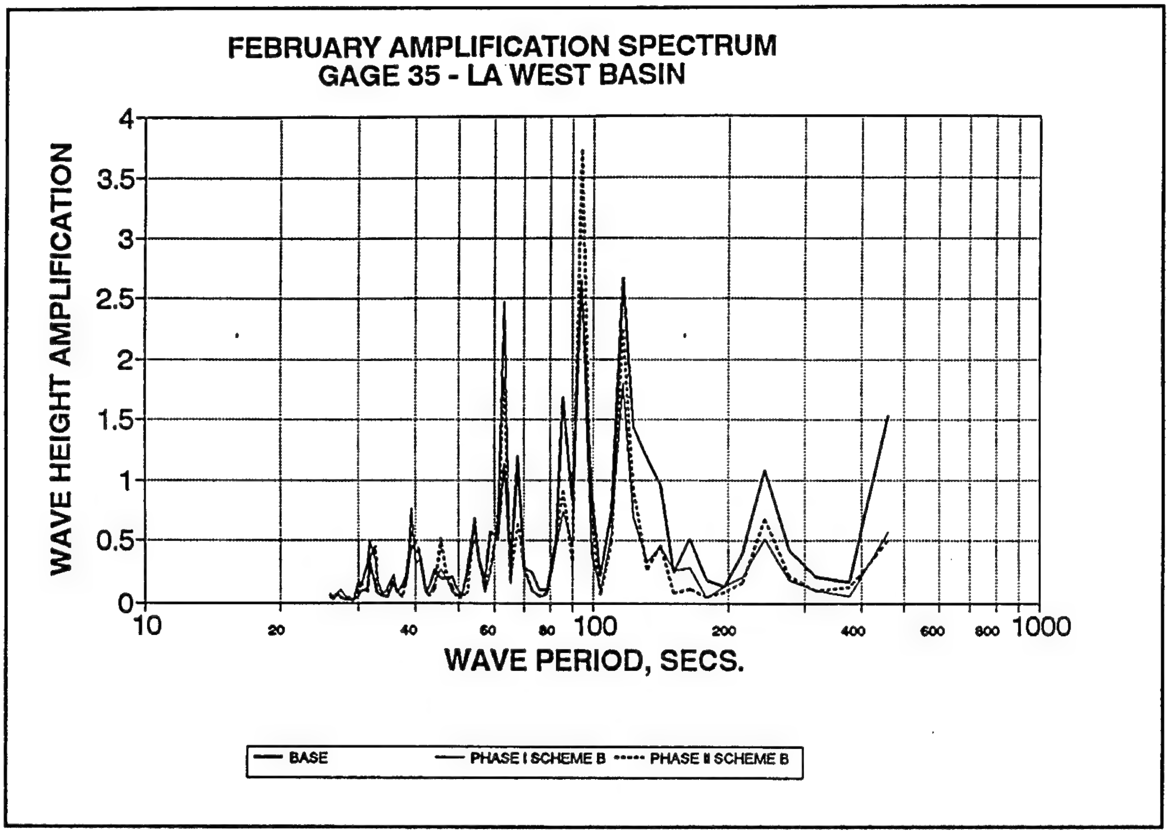
FEBRUARY AMPLIFICATION SPECTRUM
GAGE 32 - CABRILLO BASIN
WAVE HEIGHT AMPLIFICATION
0
2
4
6
8
10
12
14
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B



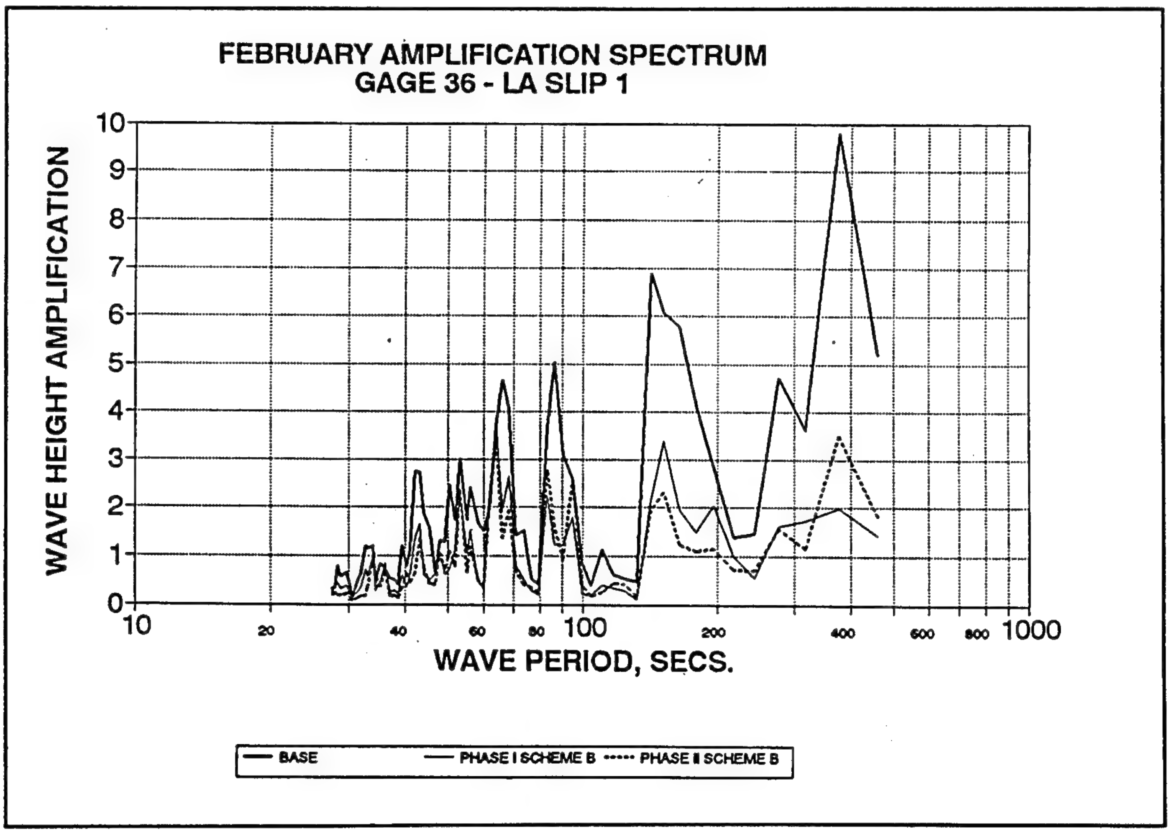
FEBRUARY AMPLIFICATION SPECTRUM
GAGE 33 - LA EAST CHANNEL BERTH 52
WAVE HEIGHT AMPLIFICATION
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B

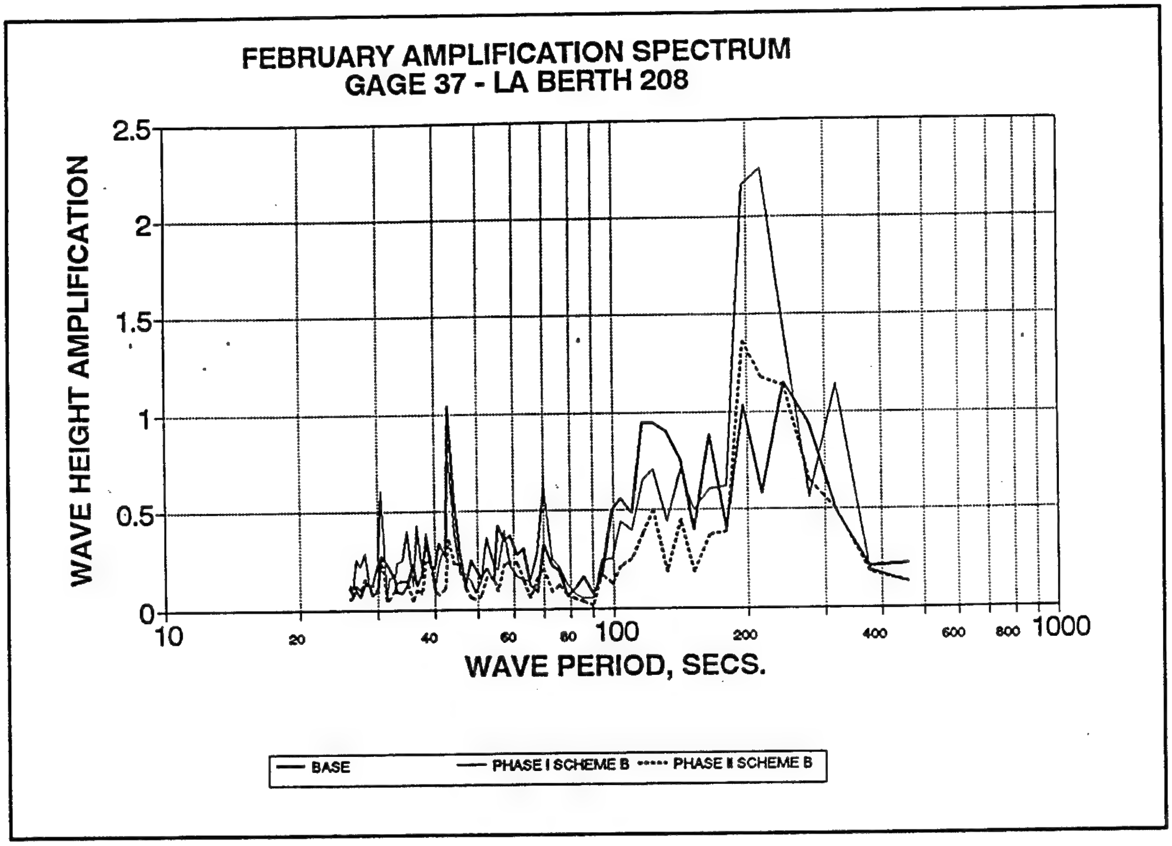
FEBRUARY AMPLIFICATION SPECTRUM
GAGE 34 - LA DRY DOCK
WAVE HEIGHT AMPLIFICATION
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

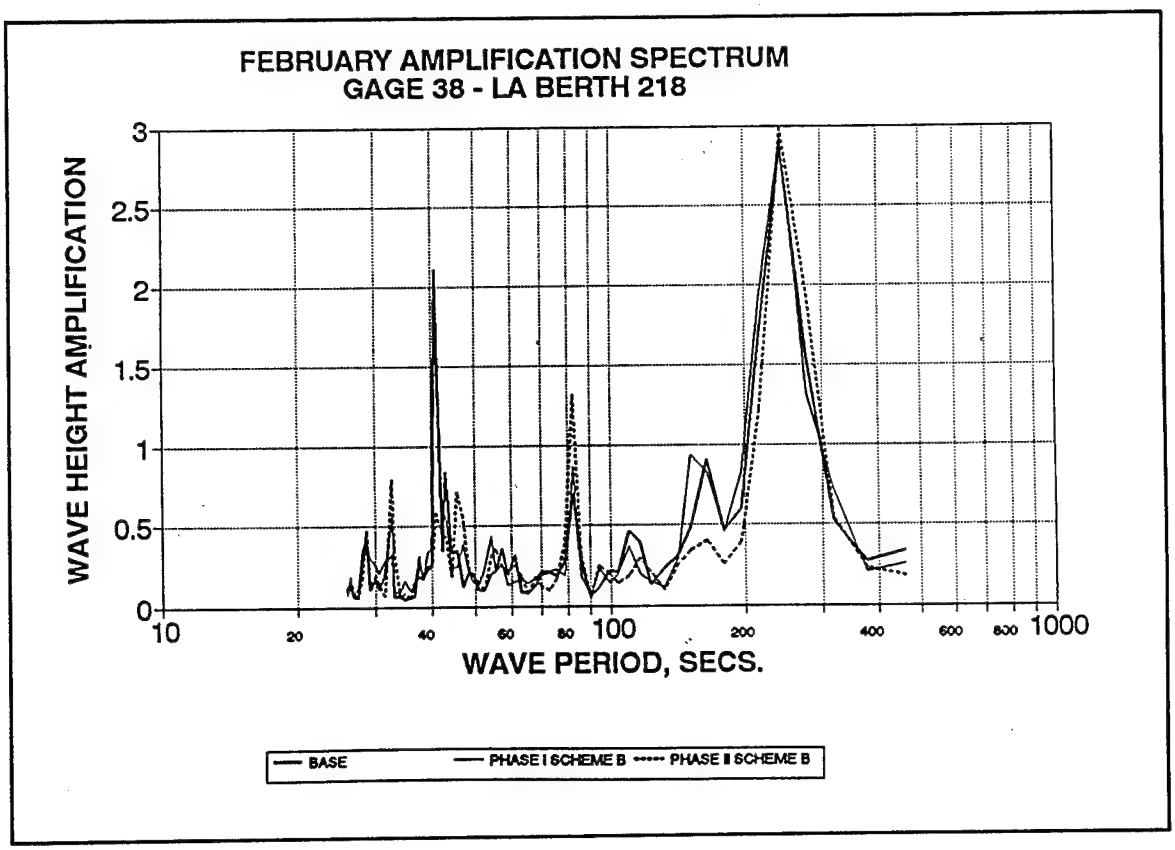


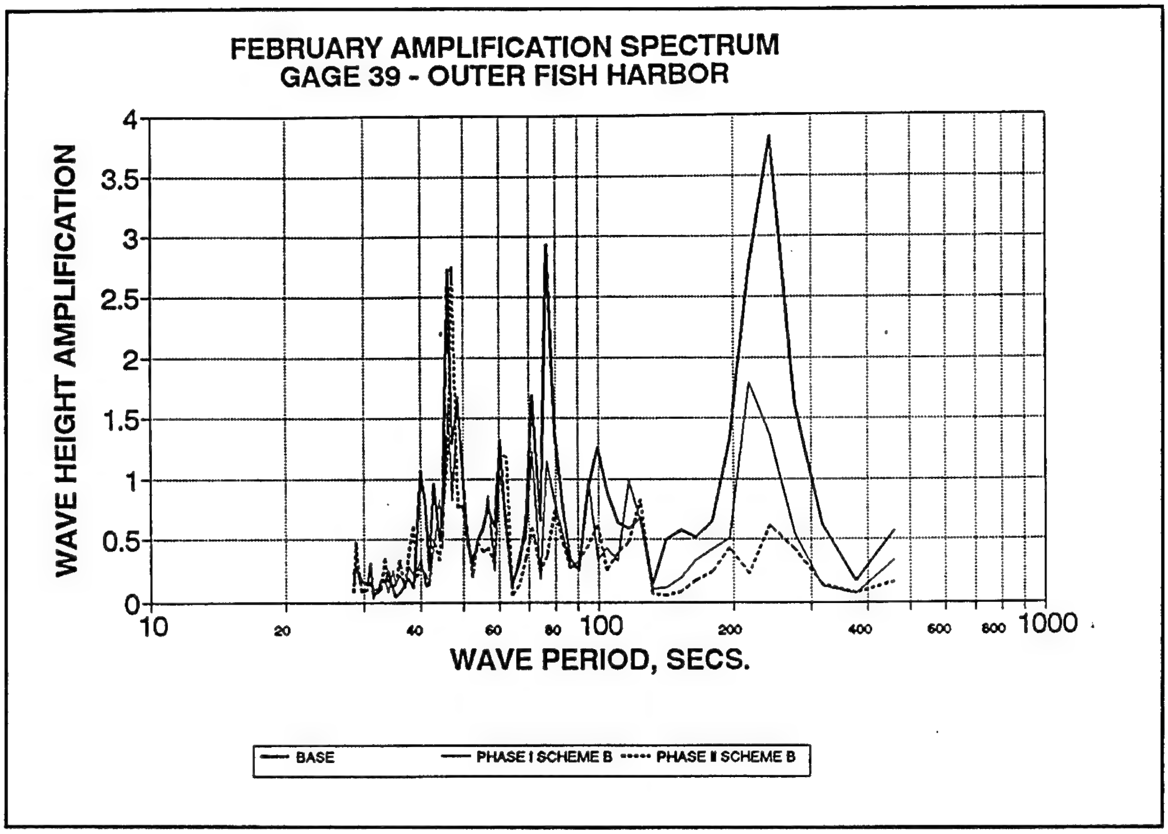
FEBRUARY AMPLIFICATION SPECTRUM
GAGE 35 - LA WEST BASIN
WAVE HEIGHT AMPLIFICATION
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

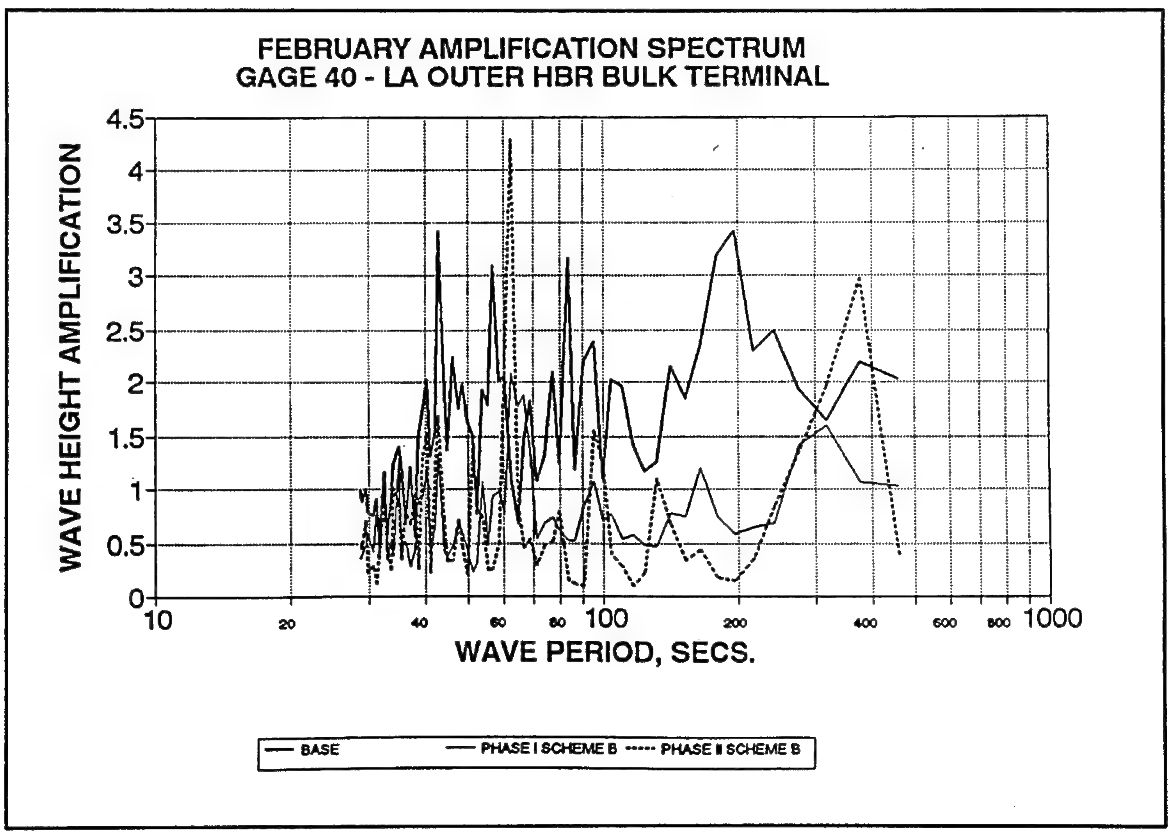



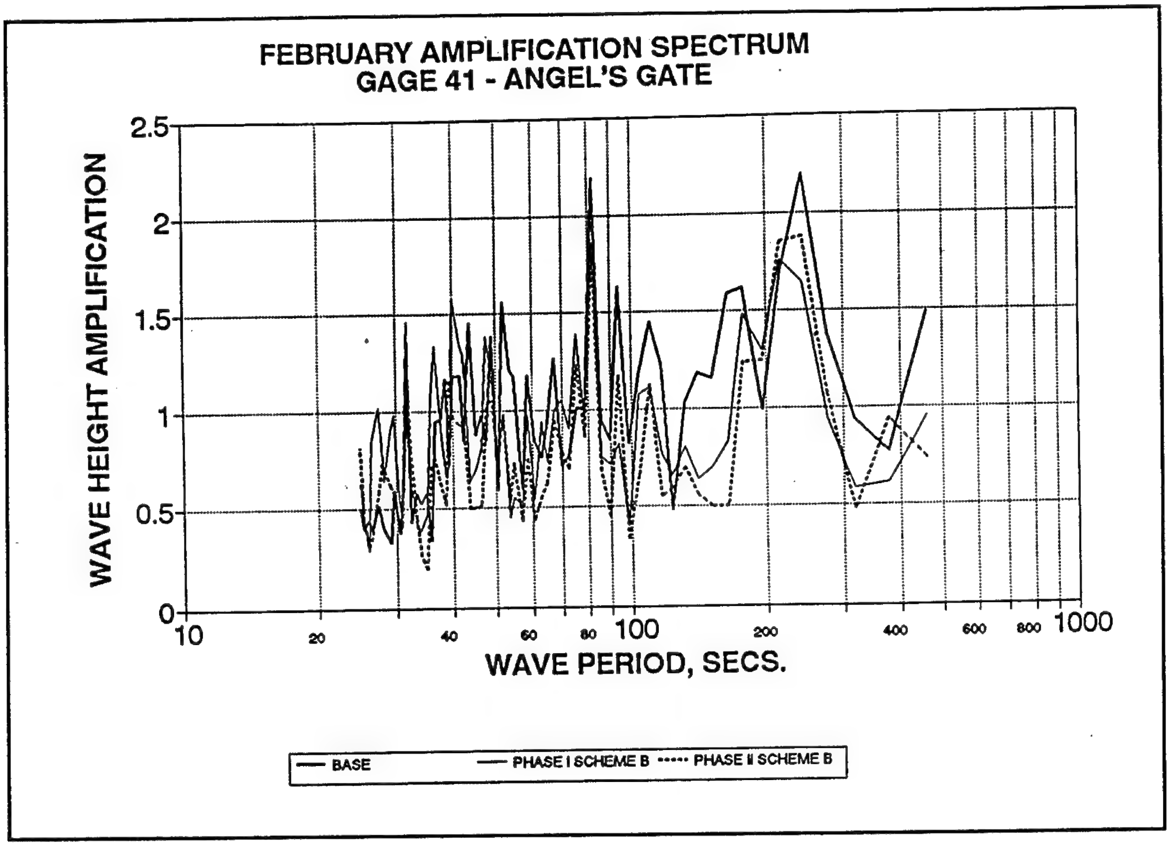
FEBRUARY AMPLIFICATION SPECTRUM
GAGE 36 - LA SLIP 1
WAVE HEIGHT AMPLIFICATION
10
9
8
7
6
5
4
3
2
1
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

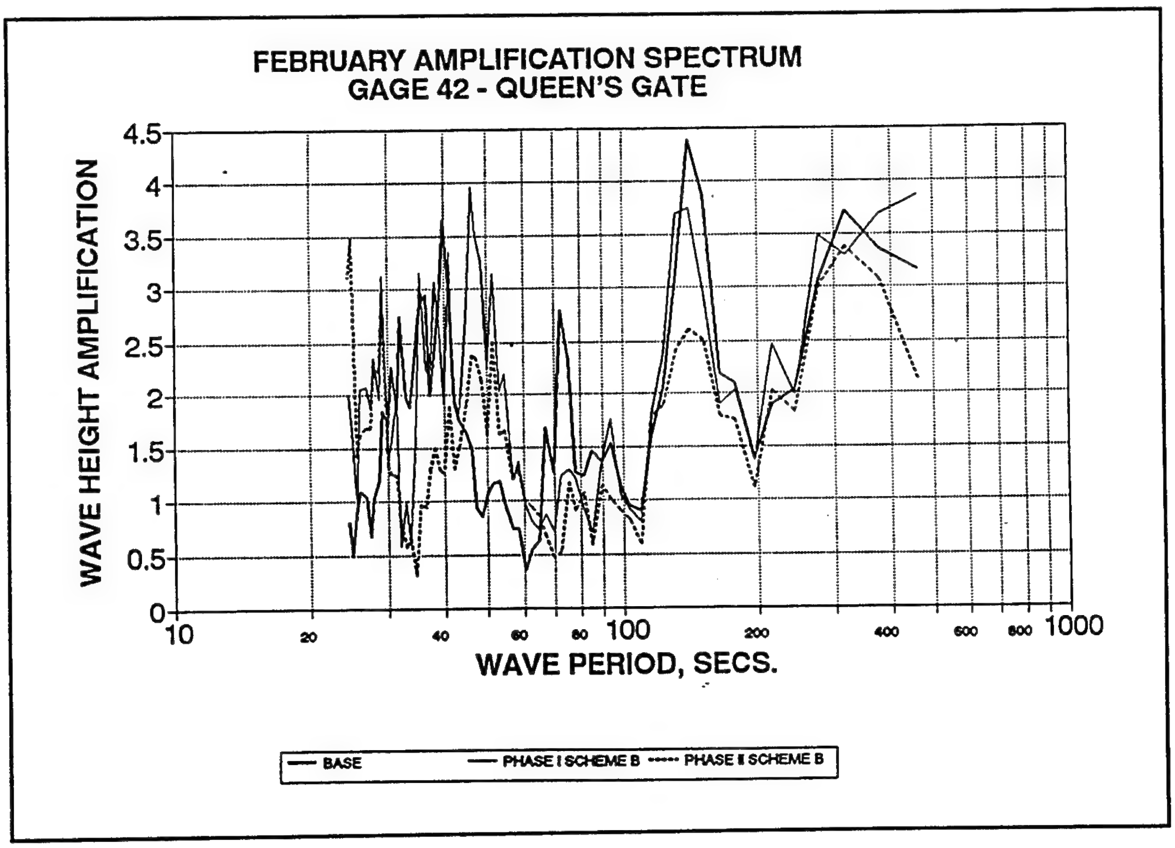

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 37 - LA BERTH 208
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

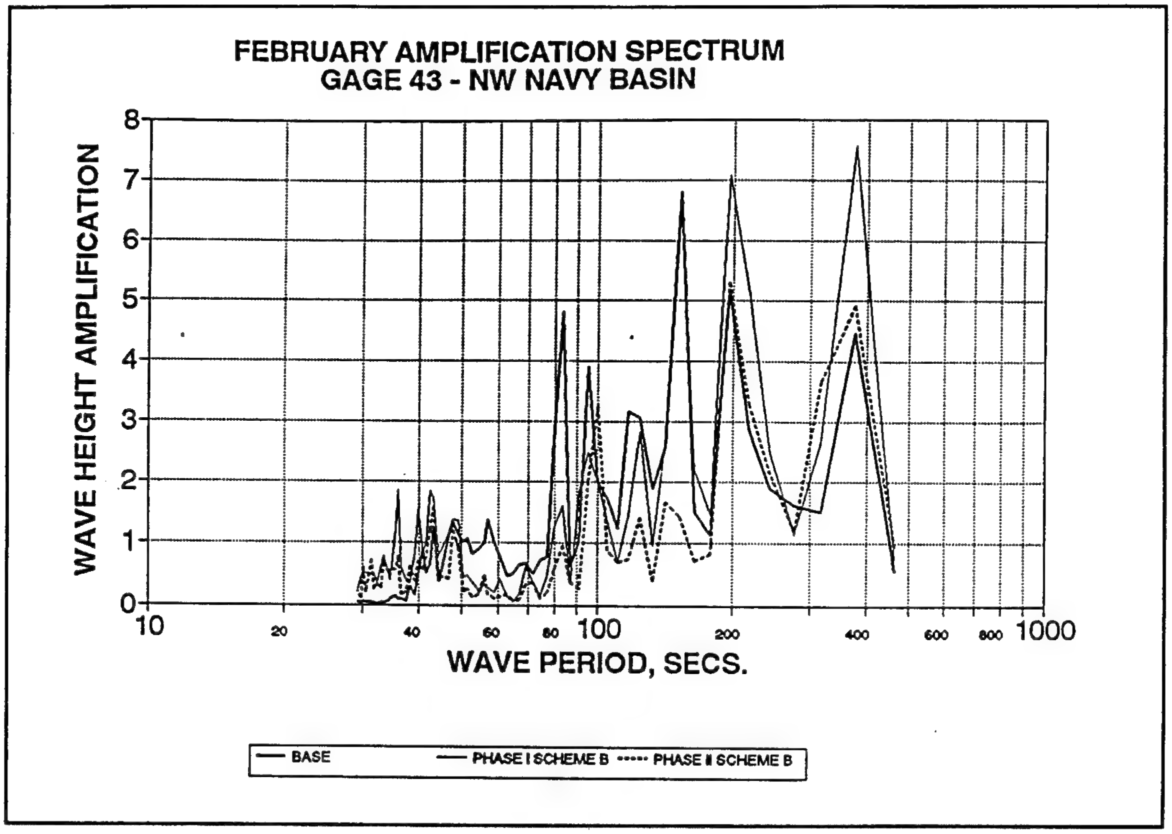

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 38 - LA BERTH 218
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

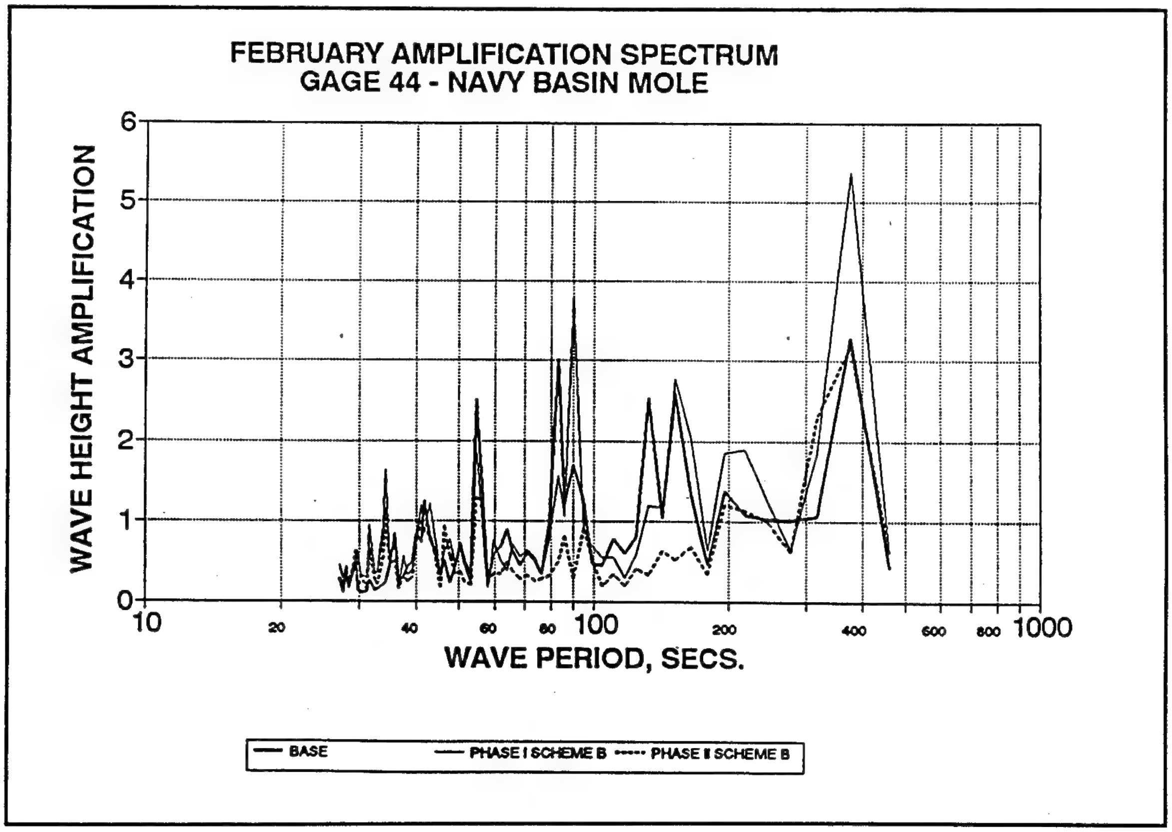

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 39 - OUTER FISH HARBOR
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
4
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

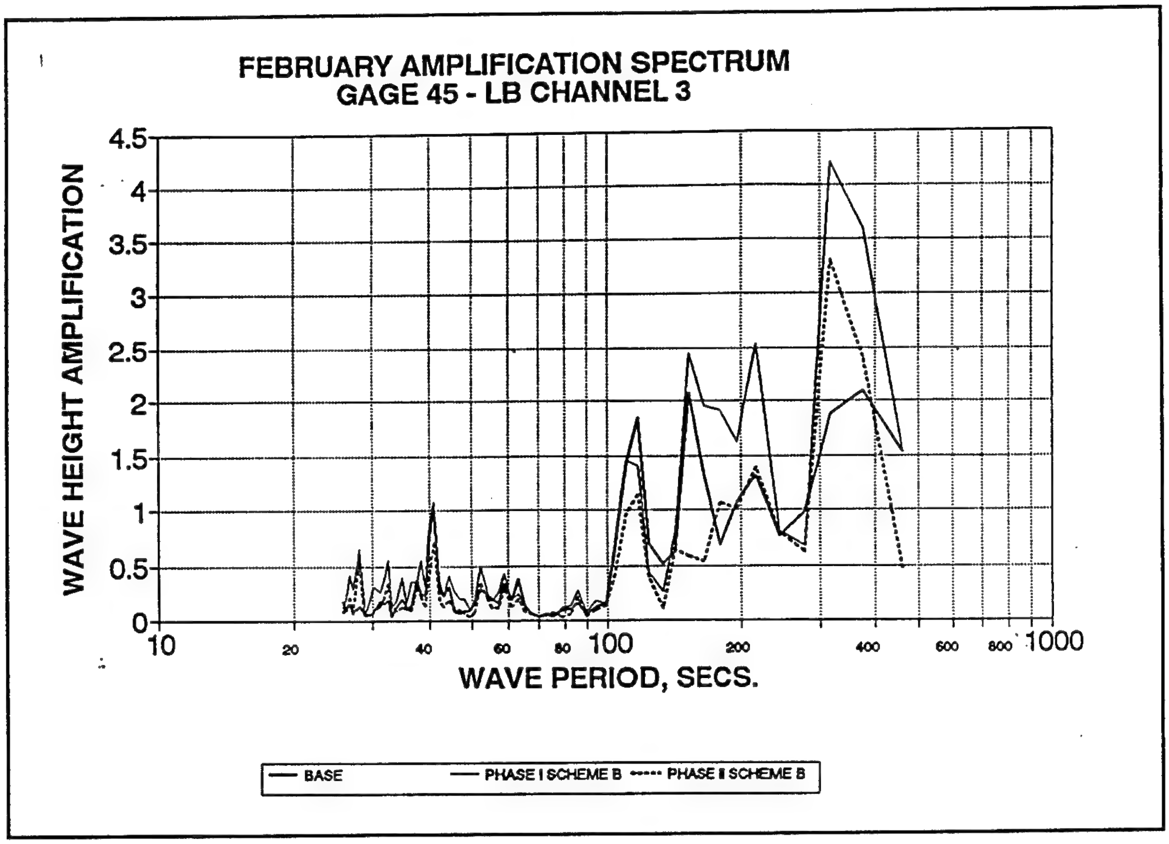

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 40 - LA OUTER HBR BULK TERMINAL
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

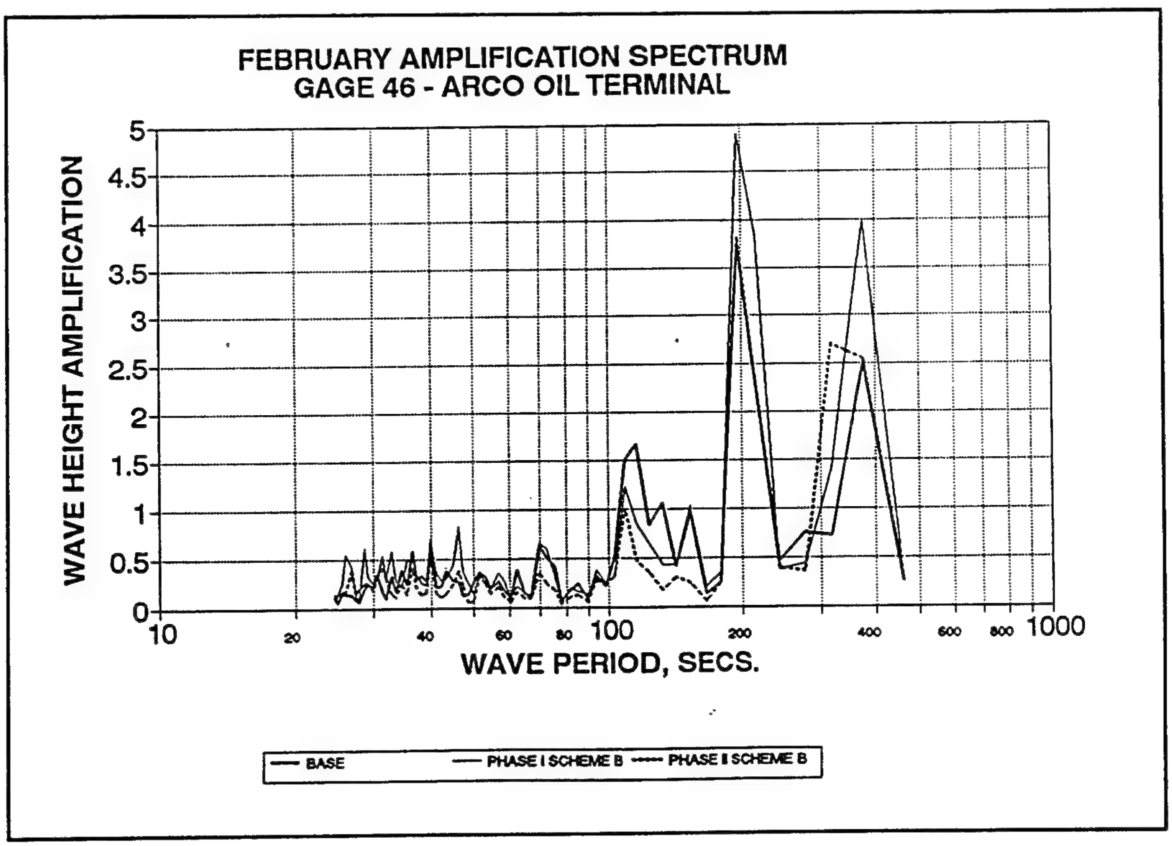

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 41 - ANGEL'S GATE
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

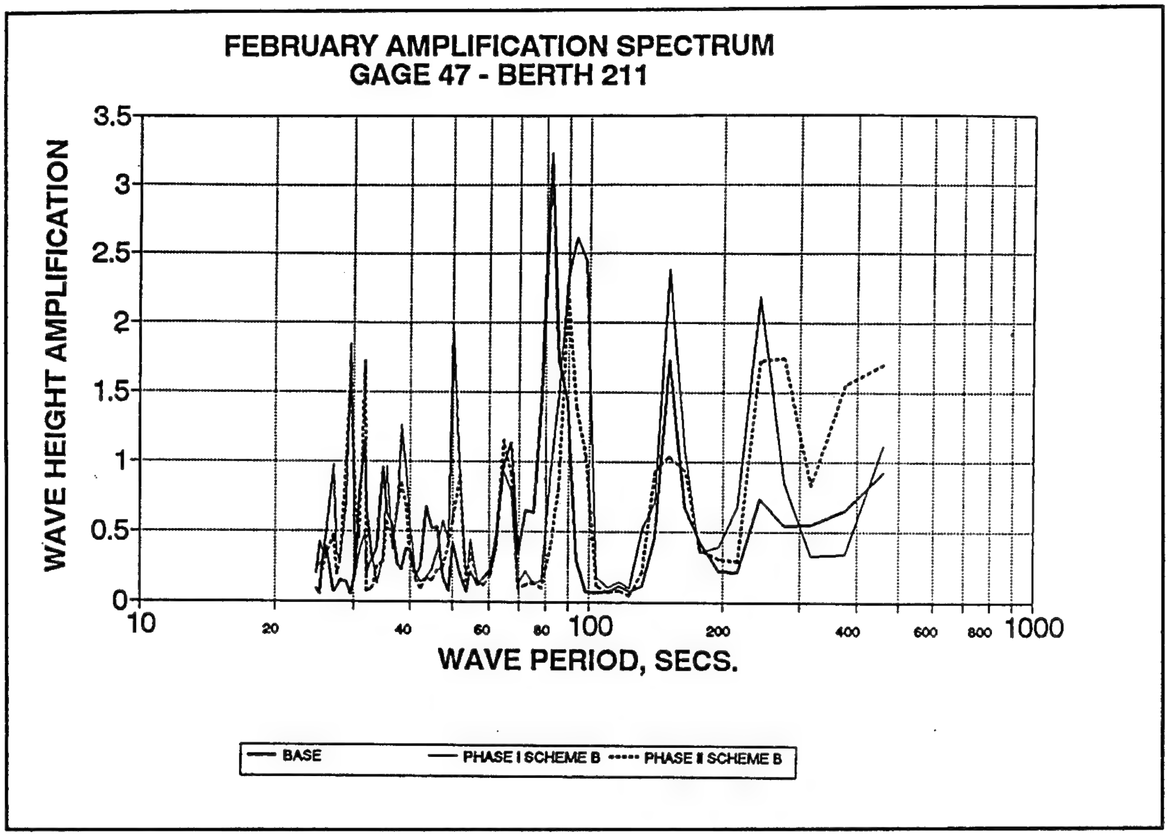

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 42 - QUEEN'S GATE
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

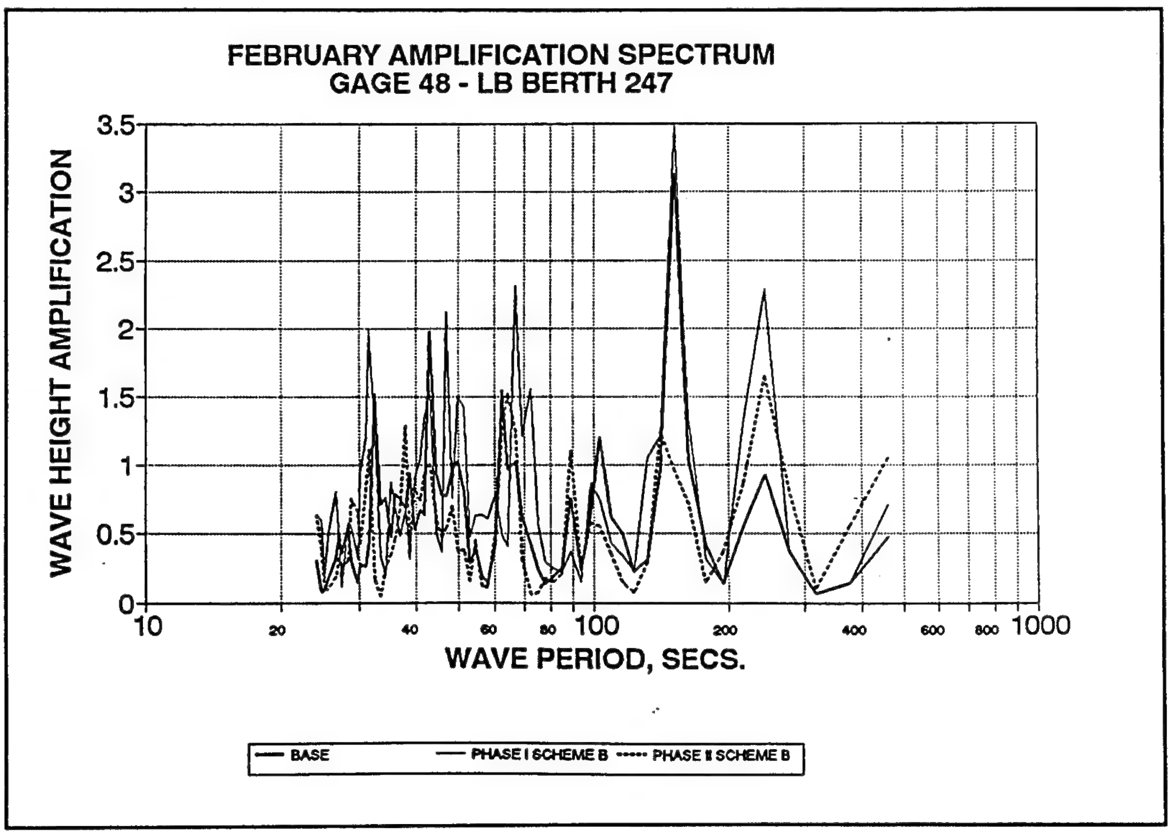

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 43 - NW NAVY BASIN
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

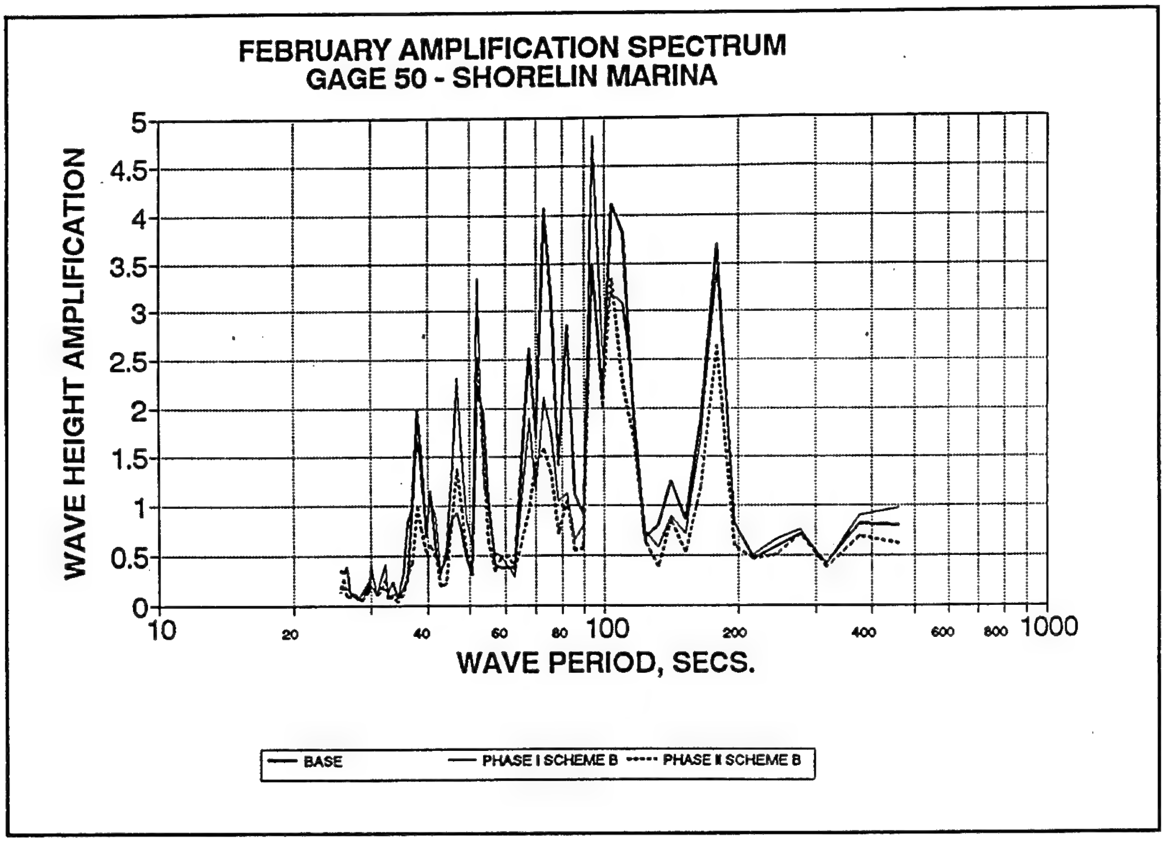

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 44 - NAVY BASIN MOLE
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

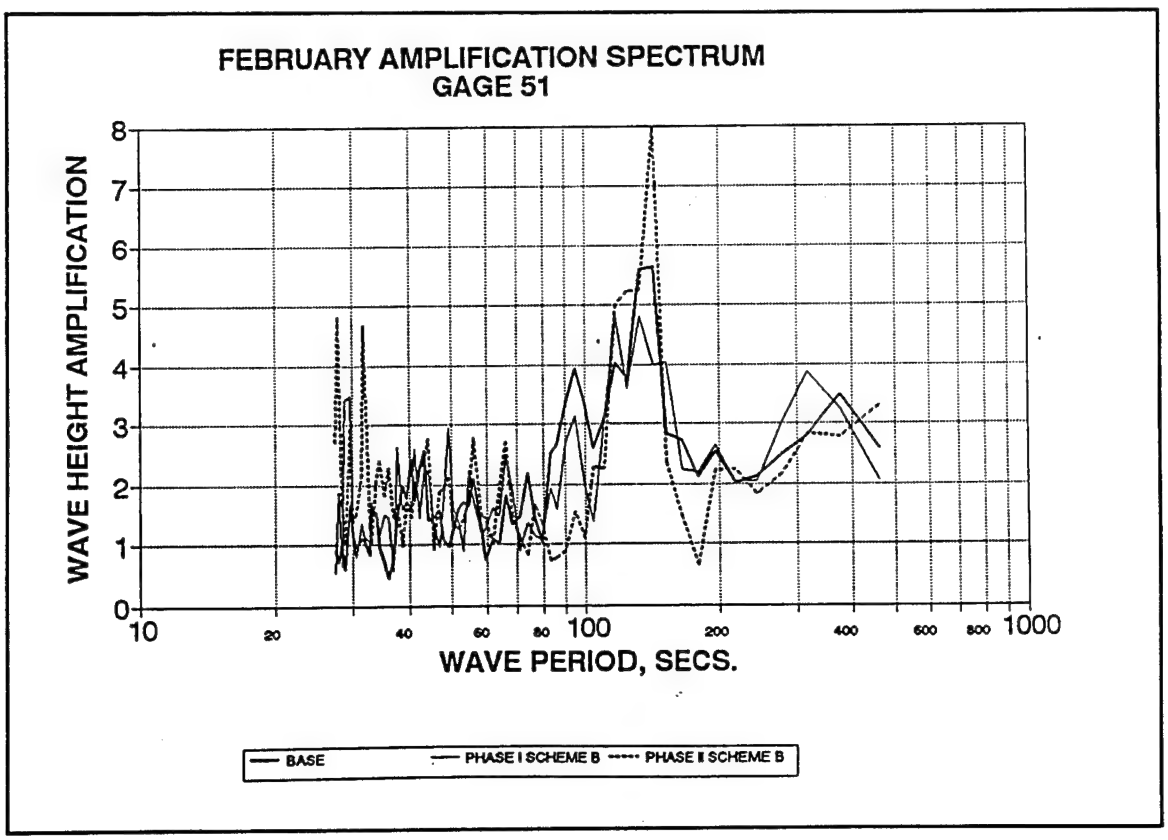

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 45 - LB CHANNEL 3
WAVE HEIGHT AMPLIFICATION
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

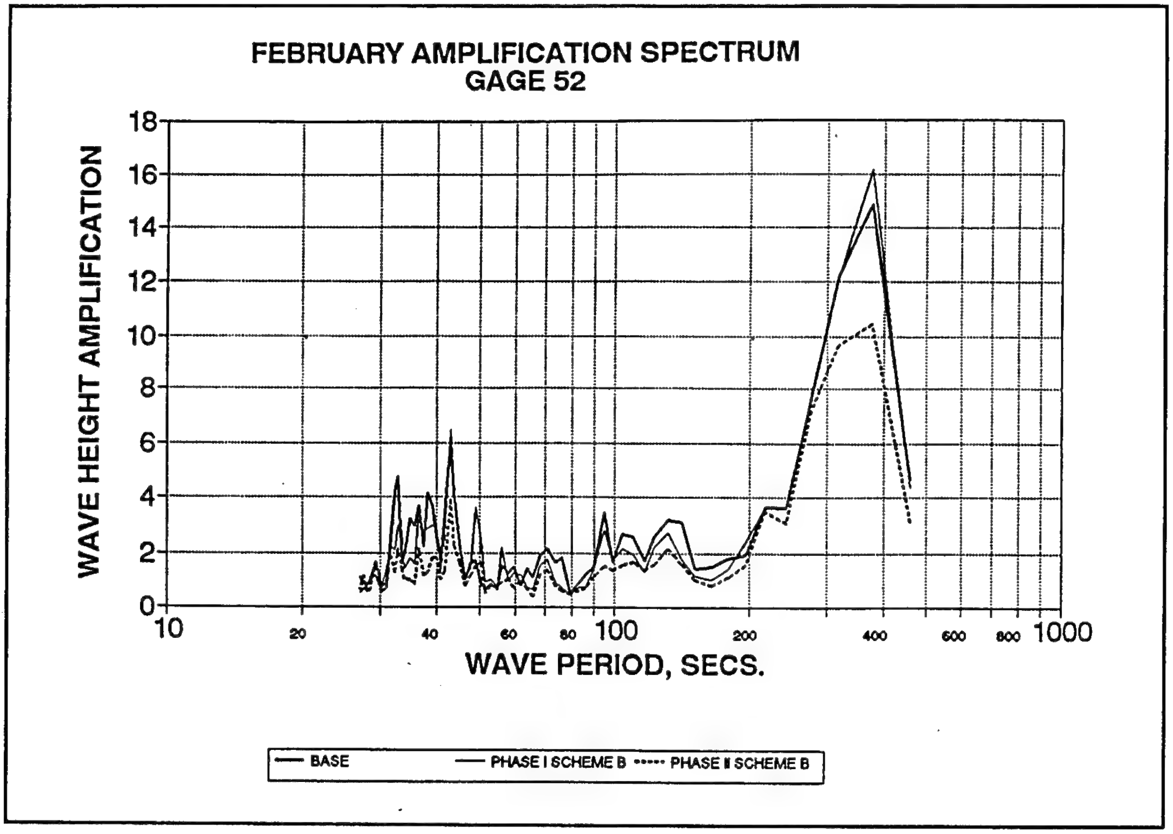

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 46 - ARCO OIL TERMINAL
WAVE HEIGHT AMPLIFICATION
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

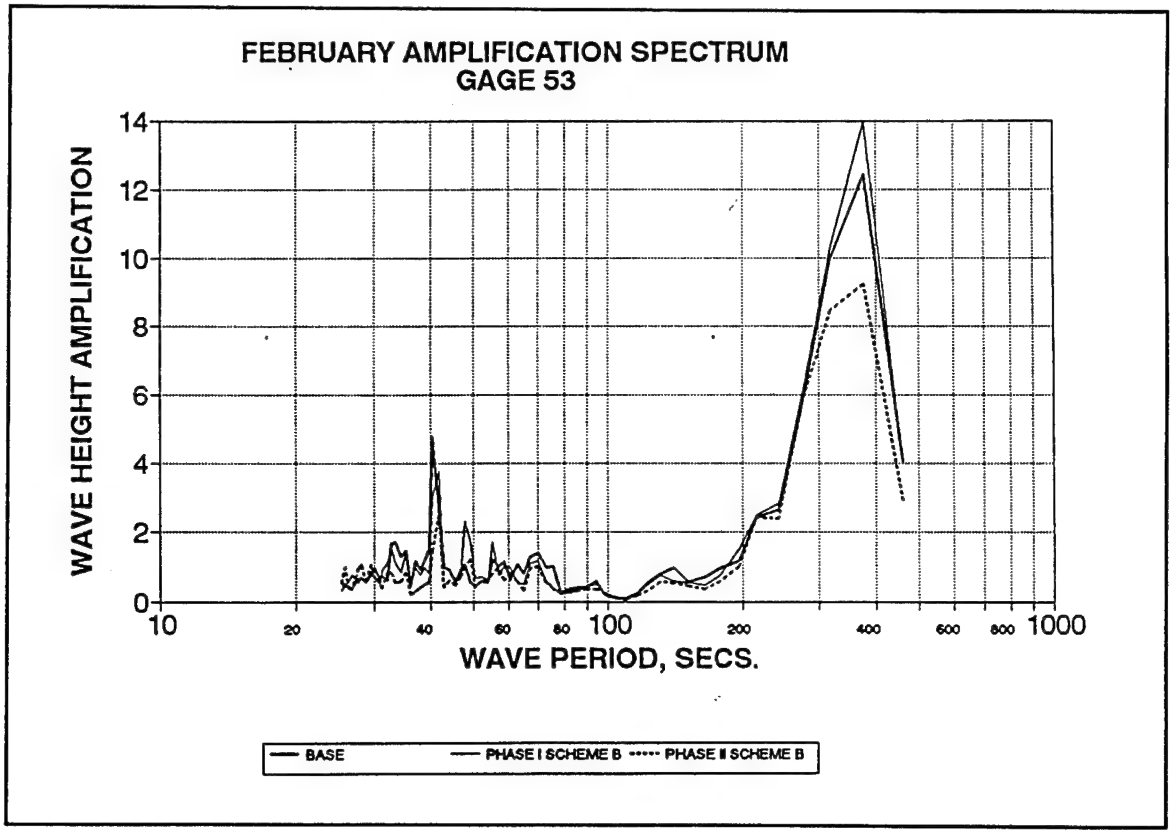

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 47 - BERTH 211
WAVE HEIGHT AMPLIFICATION
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

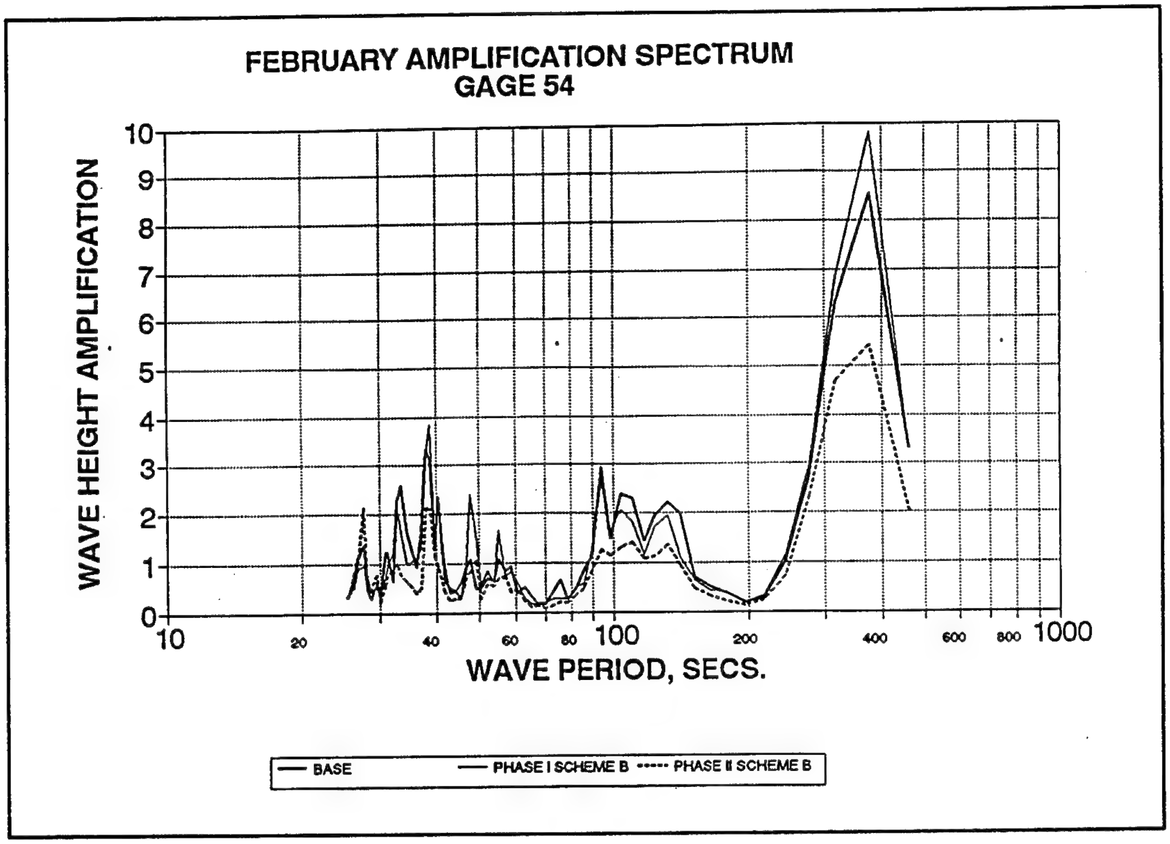

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 48 - LB BERTH 247
WAVE HEIGHT AMPLIFICATION
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

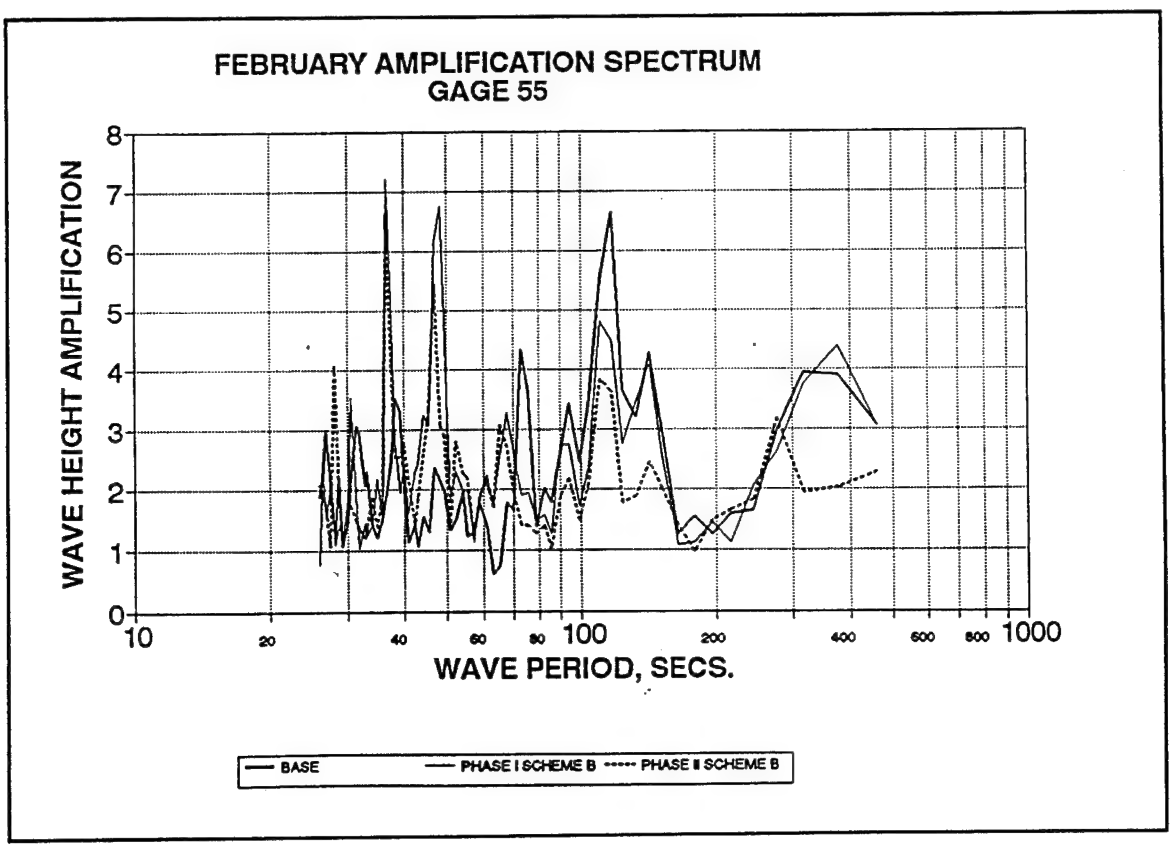

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 50 - SHORELIN MARINA
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

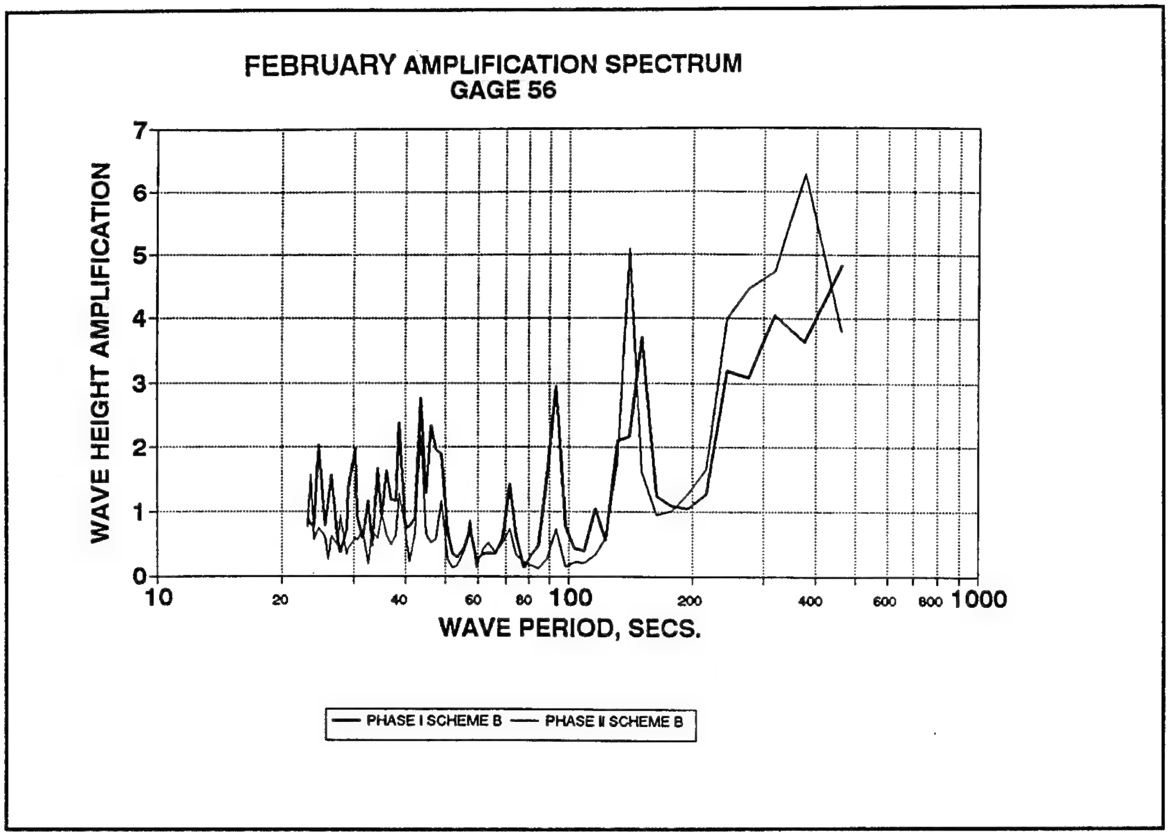

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 51
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
7
8
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B


FEBRUARY AMPLIFICATION SPECTRUM
GAGE 52
WAVE HEIGHT AMPLIFICATION
0
2
4
6
8
10
12
14
16
18
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

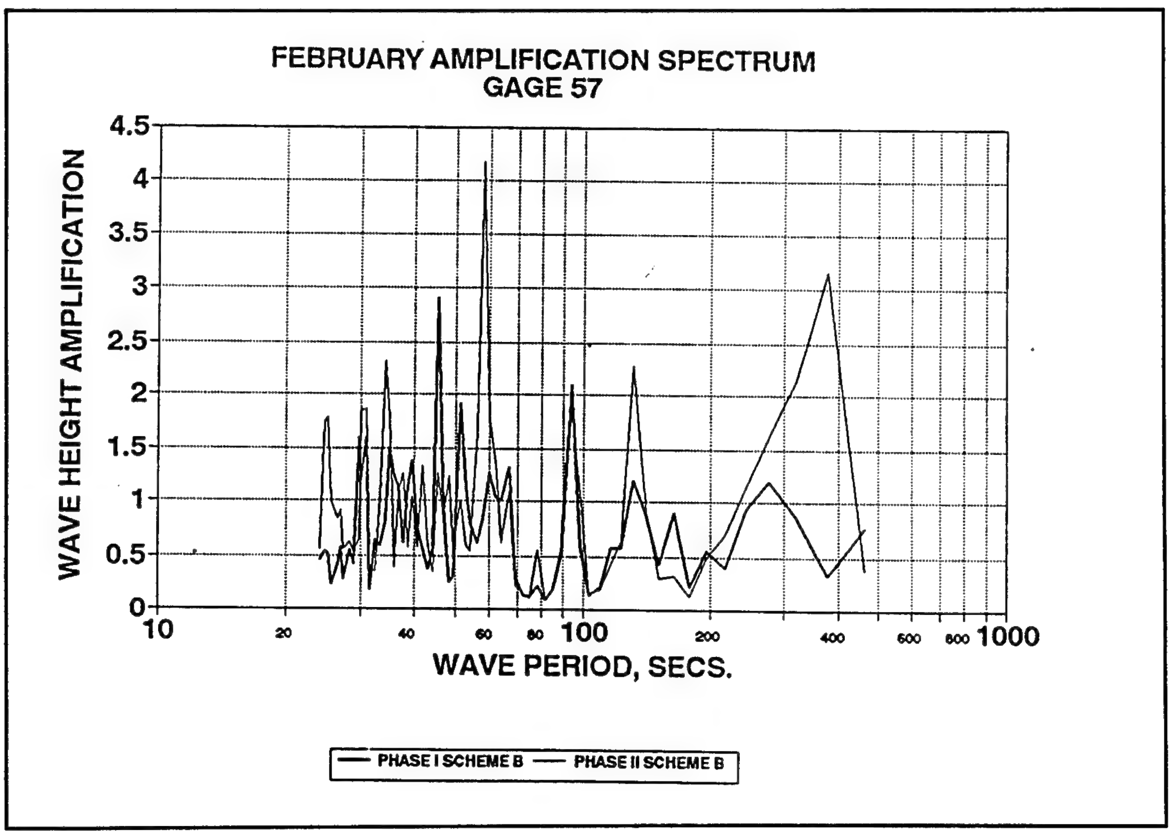

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 53
WAVE HEIGHT AMPLIFICATION
0
2
4
6
8
10
12
14
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B


FEBRUARY AMPLIFICATION SPECTRUM
GAGE 54
WAVE HEIGHT AMPLIFICATION
10
9
8
7
6
5
4
3
2
1
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

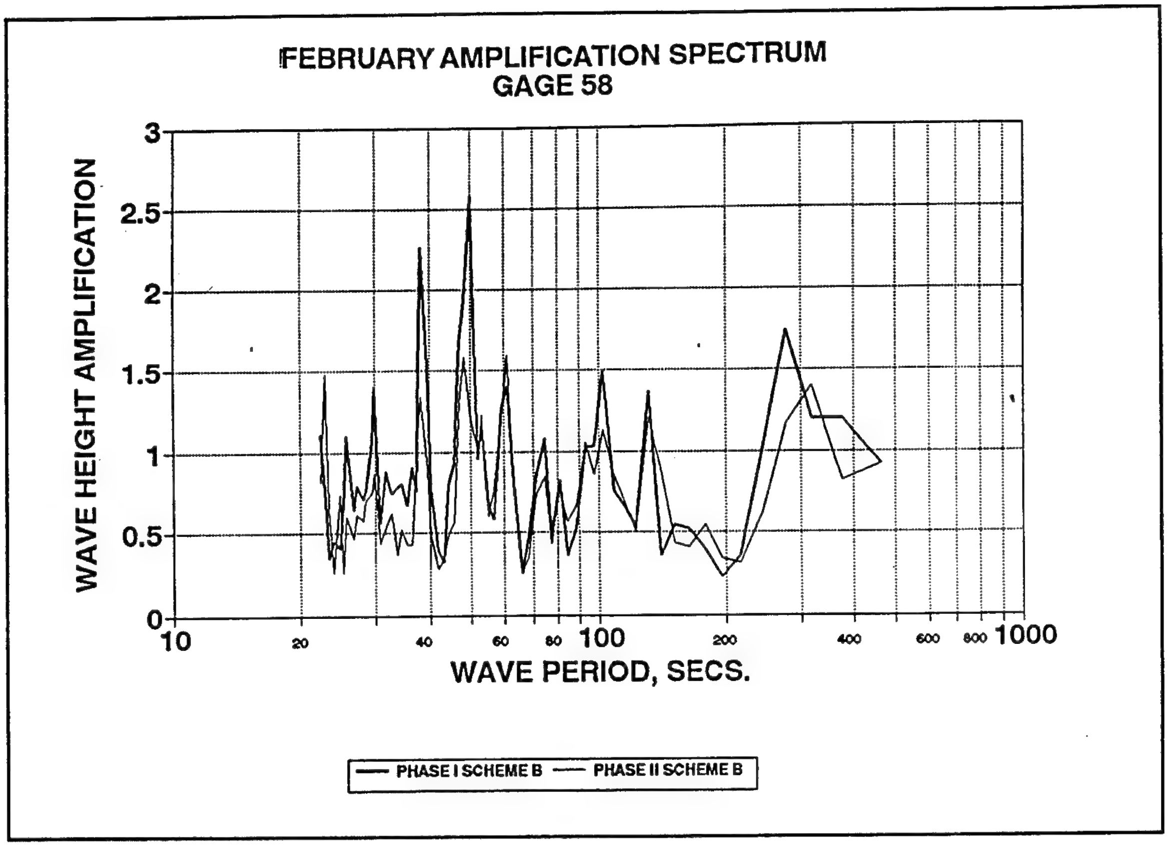

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 55
WAVE HEIGHT AMPLIFICATION
8
7
6
5
4
3
2
1
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

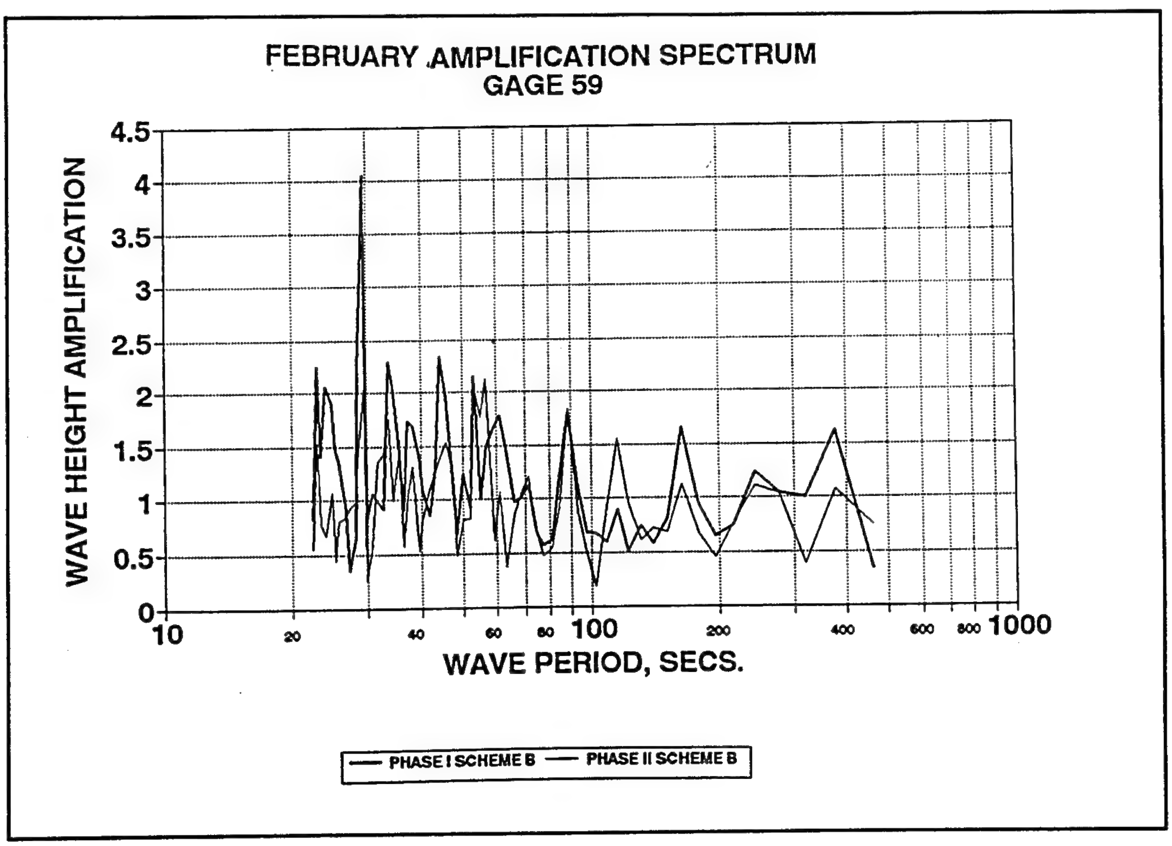


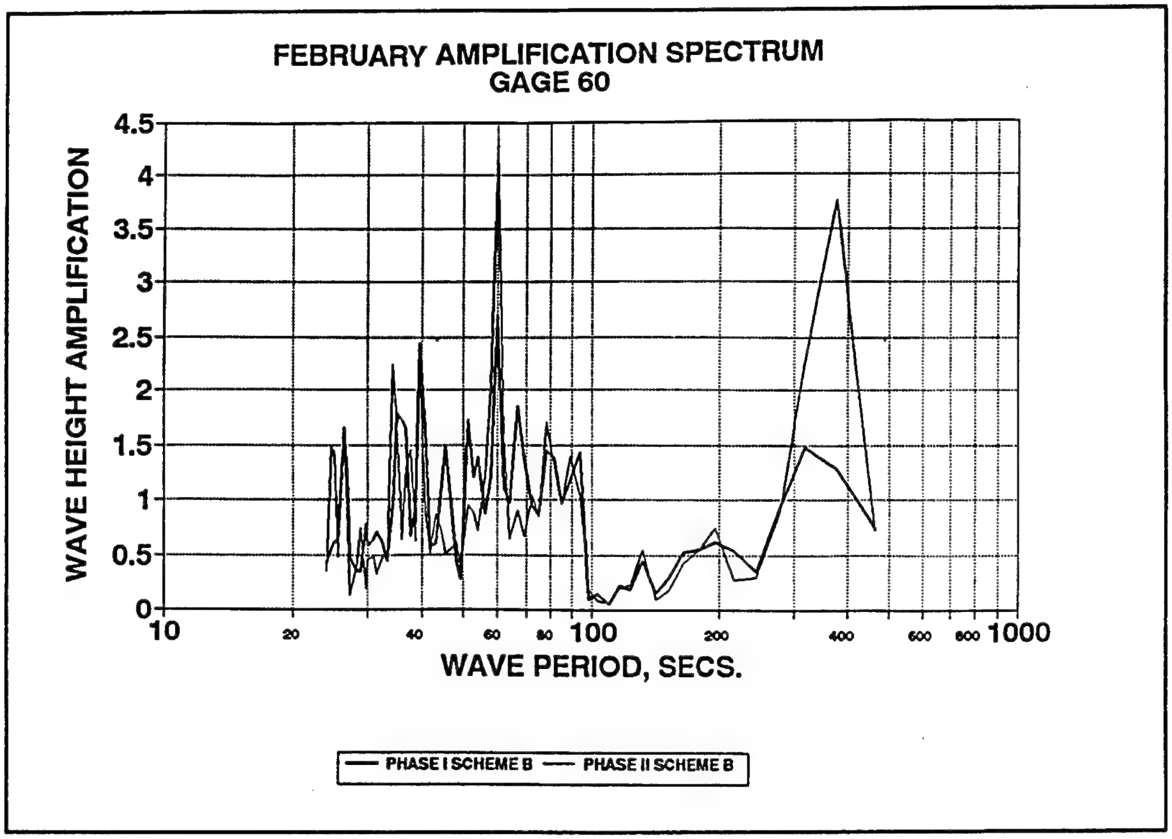
FEBRUARY AMPLIFICATION SPECTRUM
GAGE 56
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
7
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

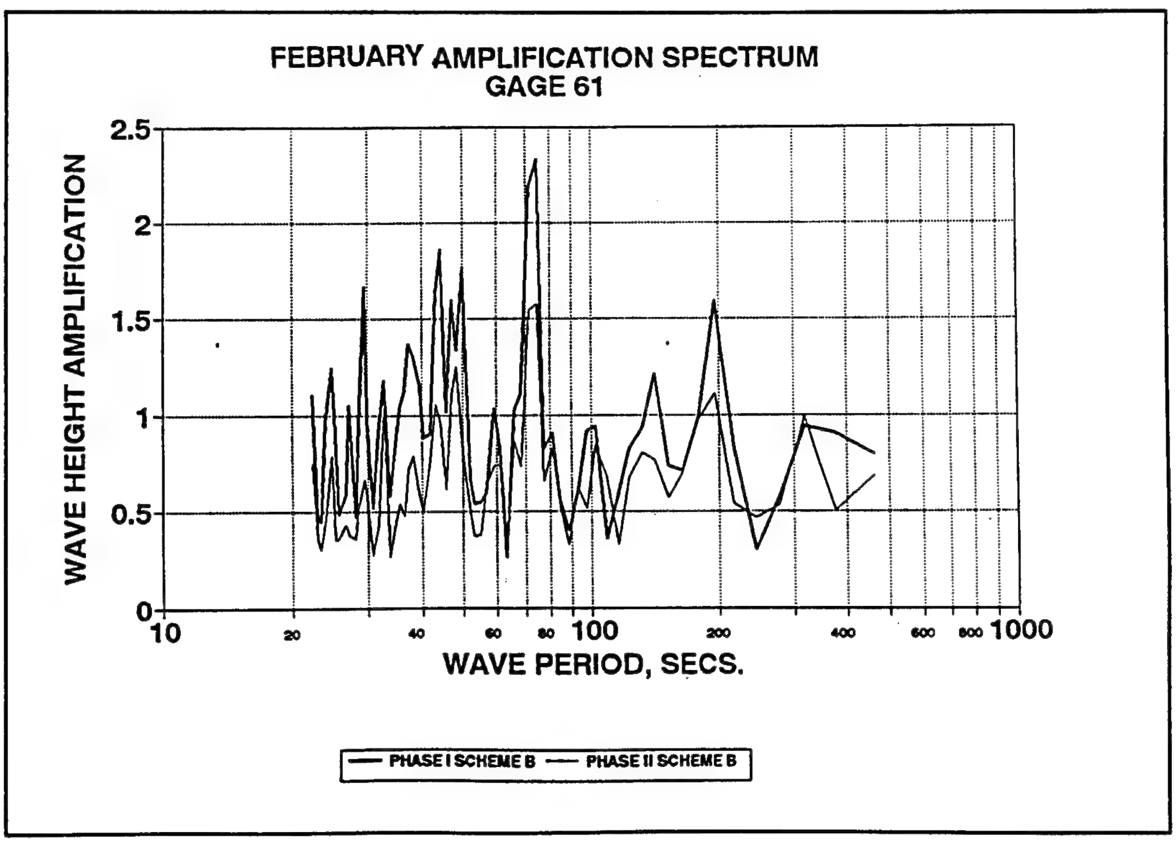



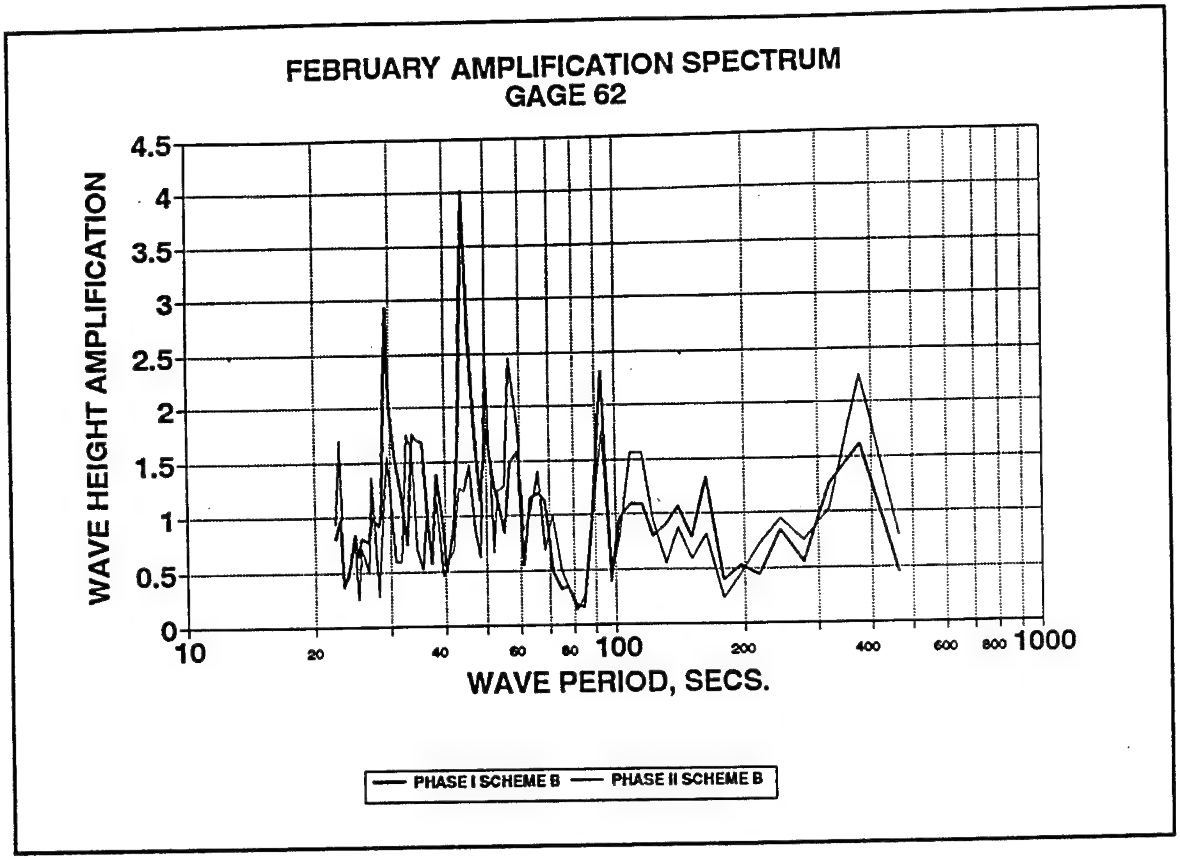
FEBRUARY AMPLIFICATION SPECTRUM
GAGE 57
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B


FEBRUARY AMPLIFICATION SPECTRUM
GAGE 58
WAVE HEIGHT AMPLIFICATION
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

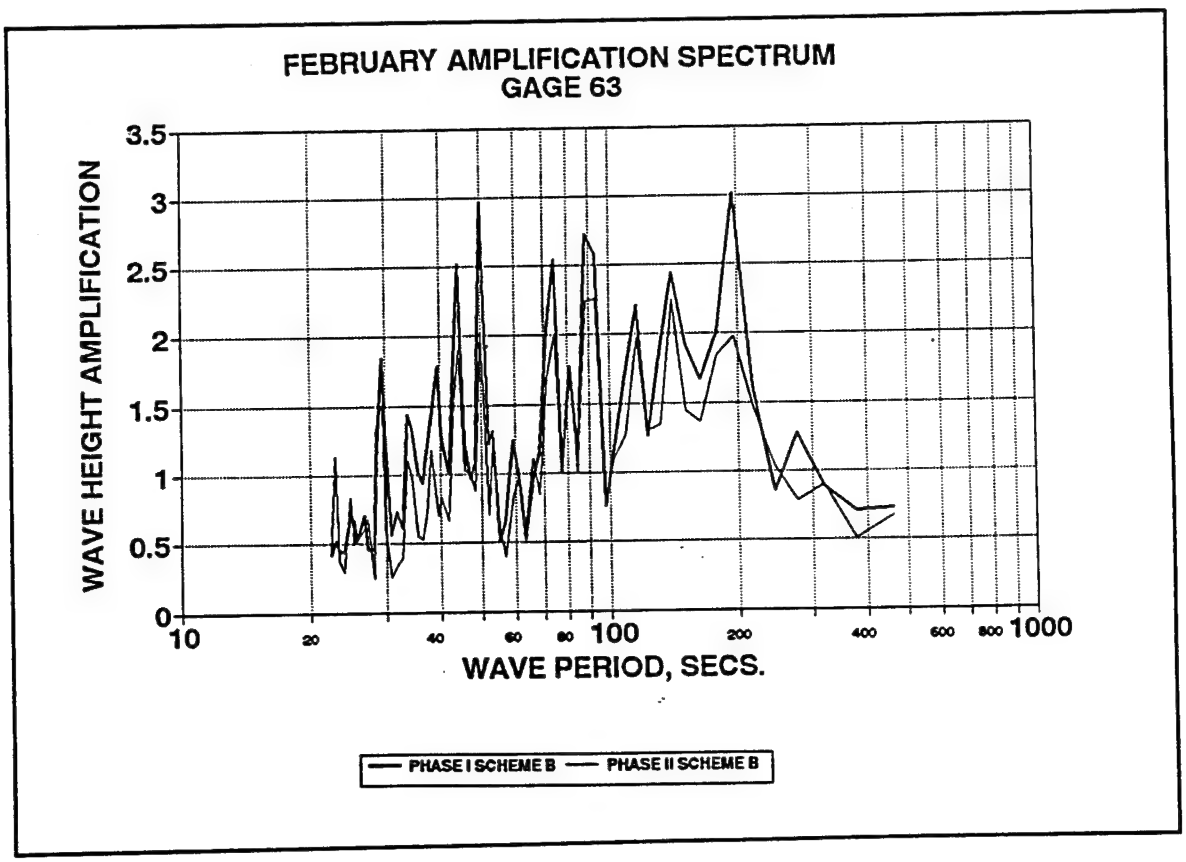

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 59
WAVE HEIGHT AMPLIFICATION
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B


FEBRUARY AMPLIFICATION SPECTRUM
GAGE 60
WAVE HEIGHT AMPLIFICATION
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

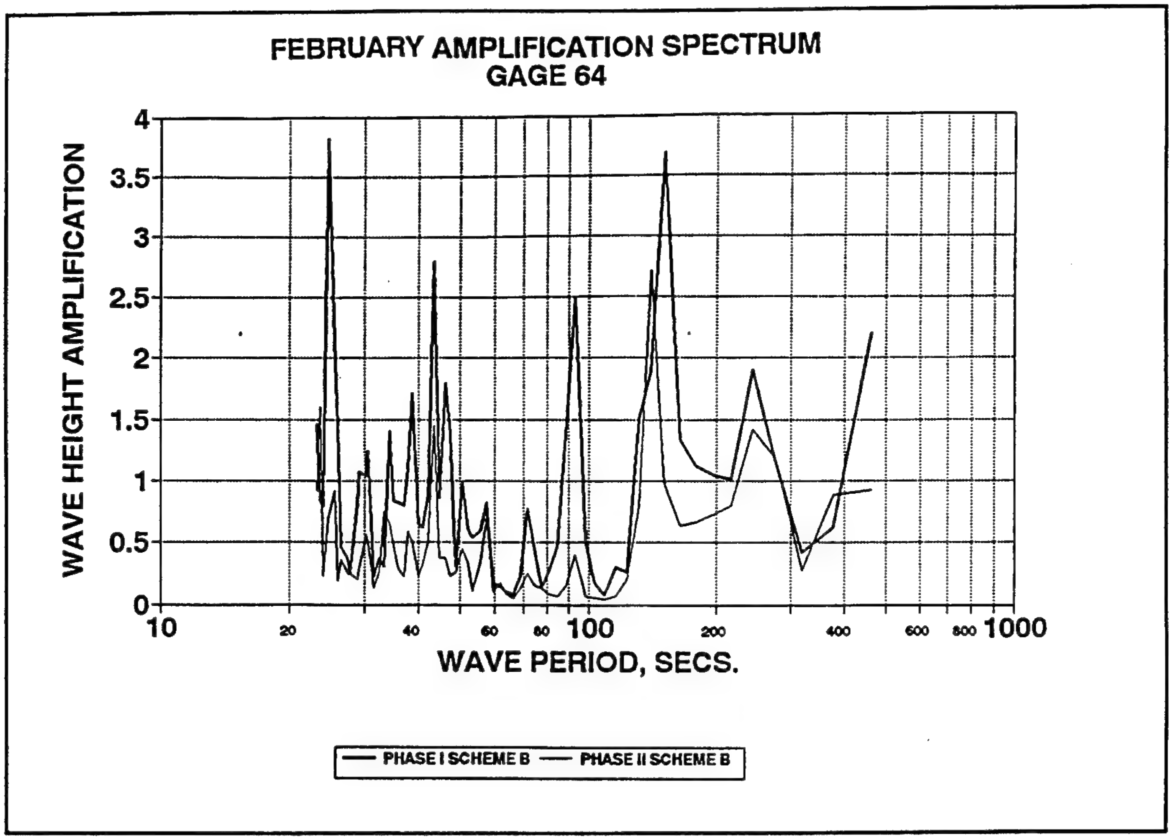

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 61
WAVE HEIGHT AMPLIFICATION
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

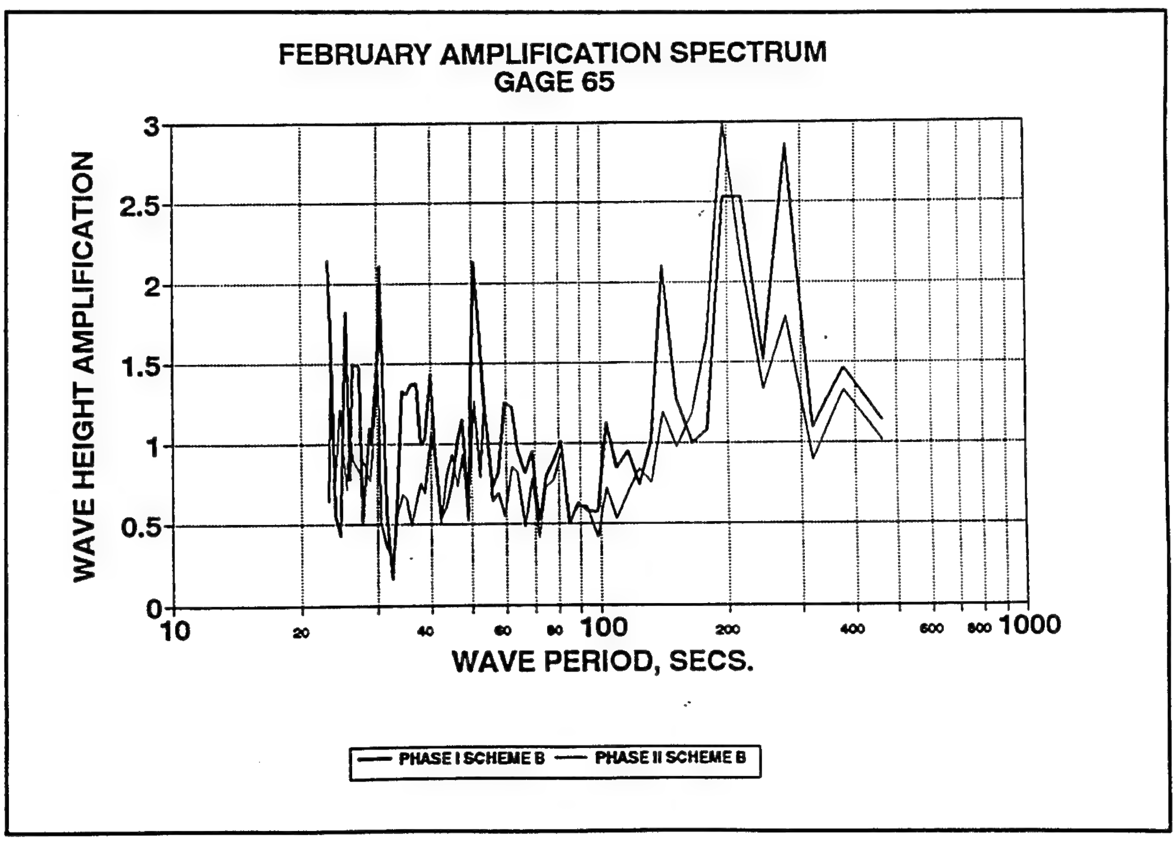


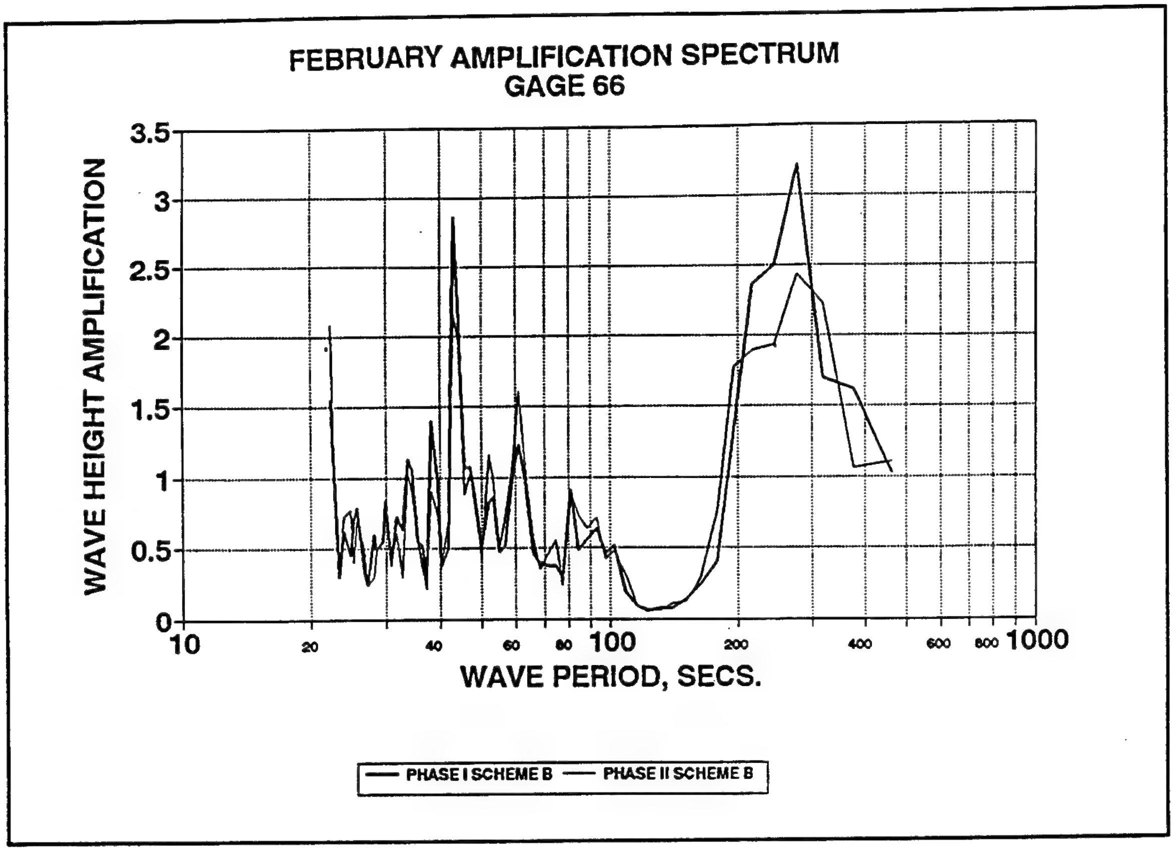
FEBRUARY AMPLIFICATION SPECTRUM
GAGE 62
WAVE HEIGHT AMPLIFICATION
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

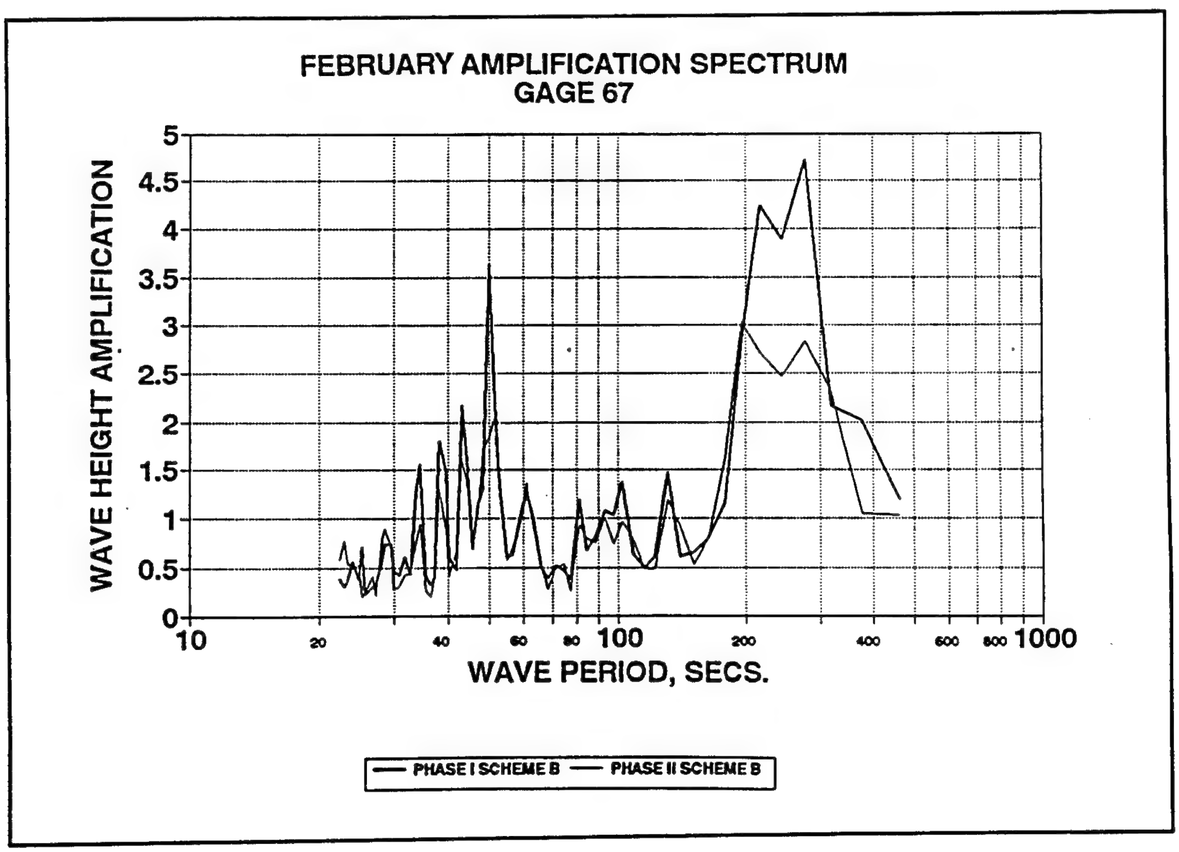



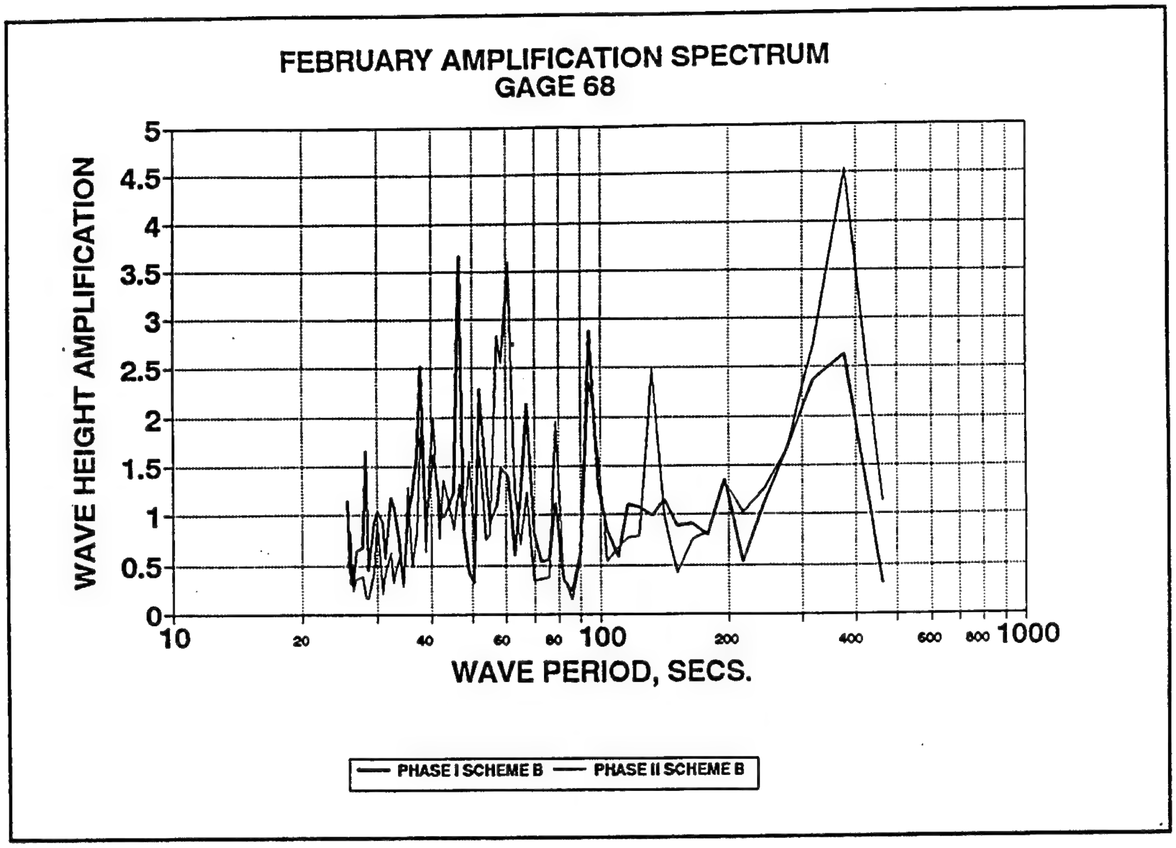
FEBRUARY AMPLIFICATION SPECTRUM
GAGE 63
WAVE HEIGHT AMPLIFICATION
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

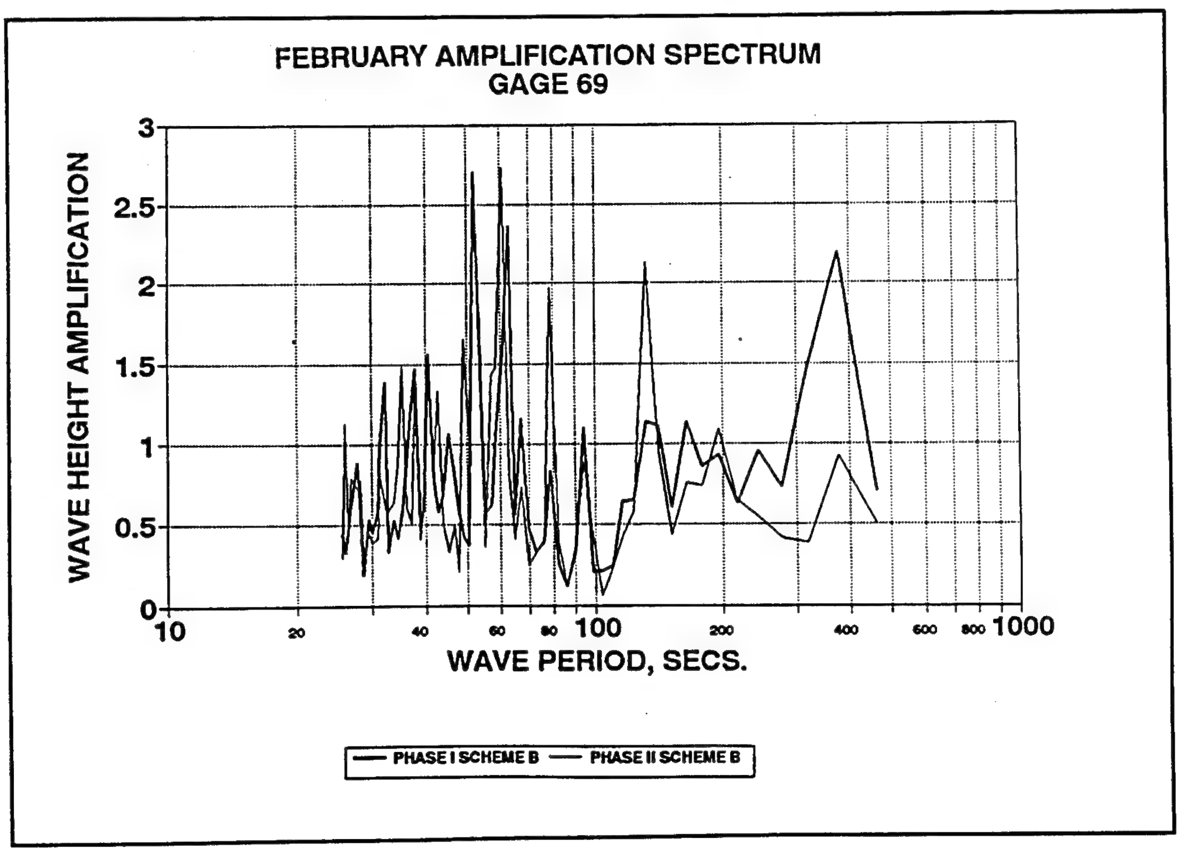

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 64
WAVE HEIGHT AMPLIFICATION
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

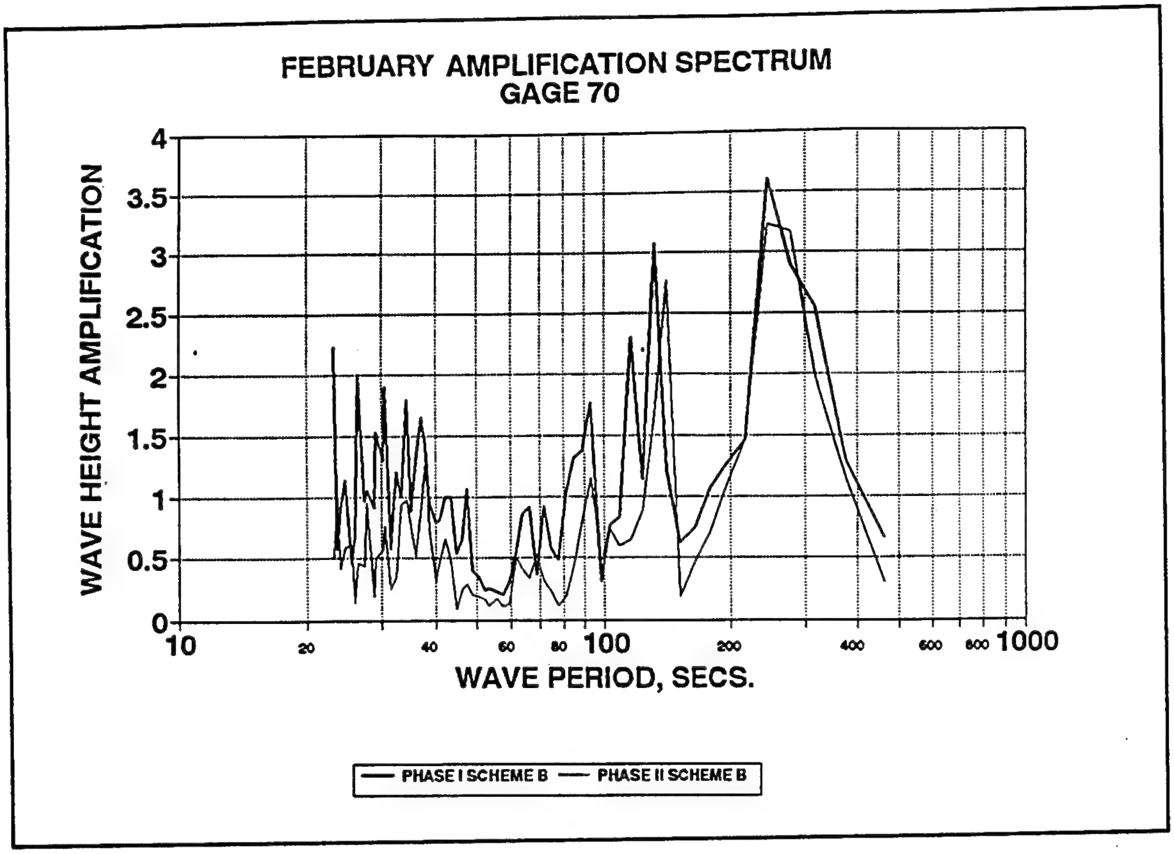

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 65
WAVE HEIGHT AMPLIFICATION
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B


FEBRUARY AMPLIFICATION SPECTRUM
GAGE 66
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

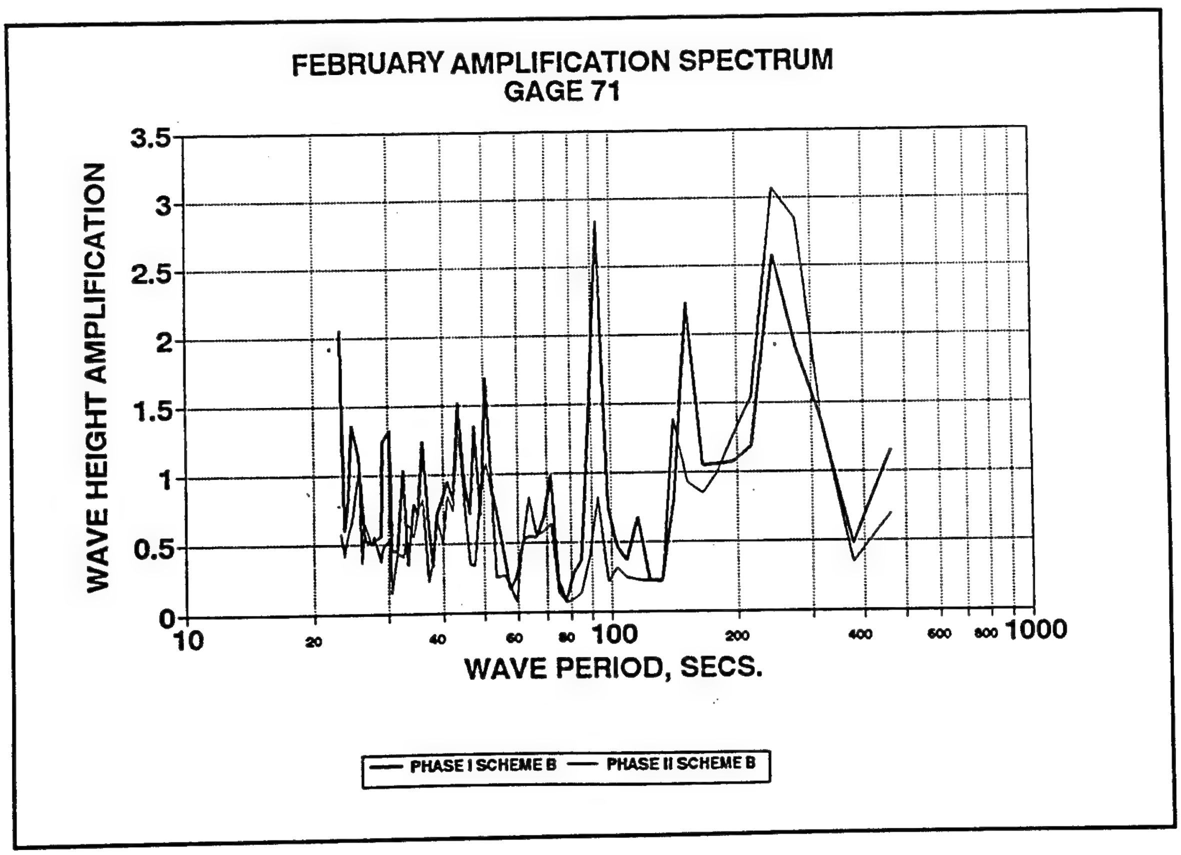

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 67
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B


FEBRUARY AMPLIFICATION SPECTRUM
GAGE 68
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

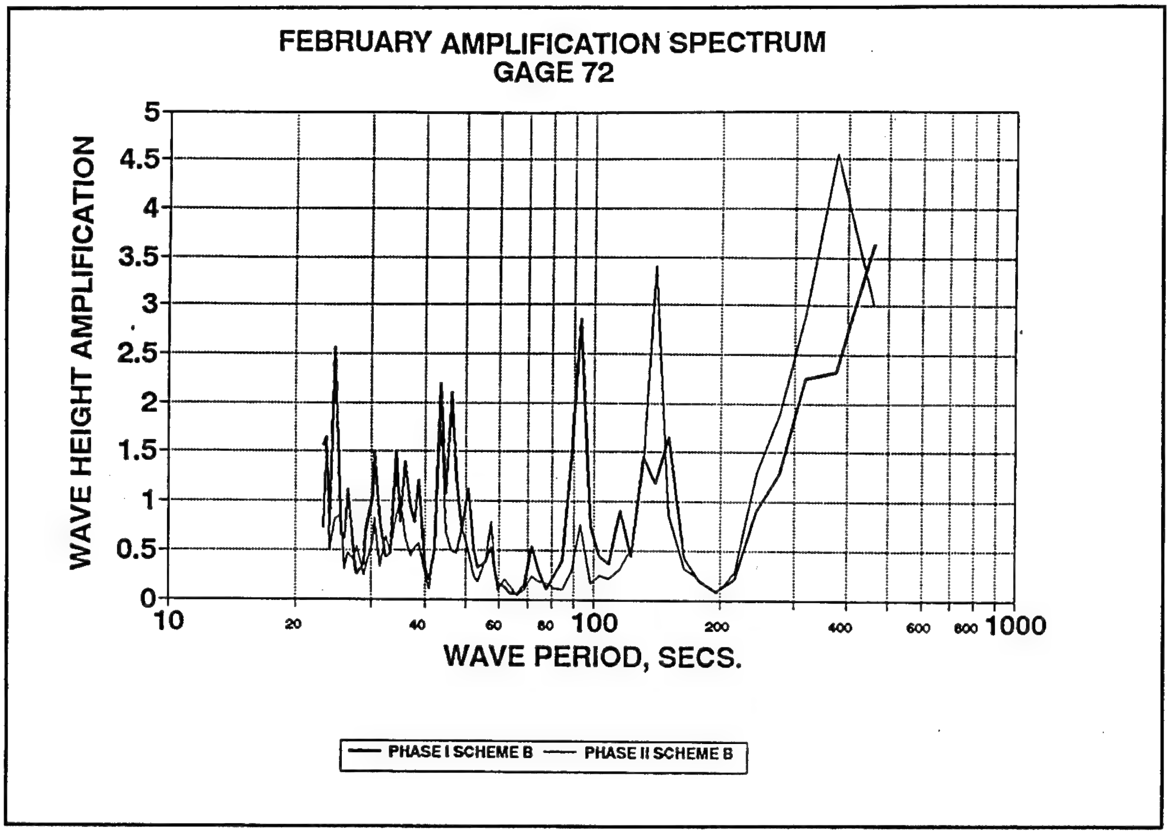

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 69
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

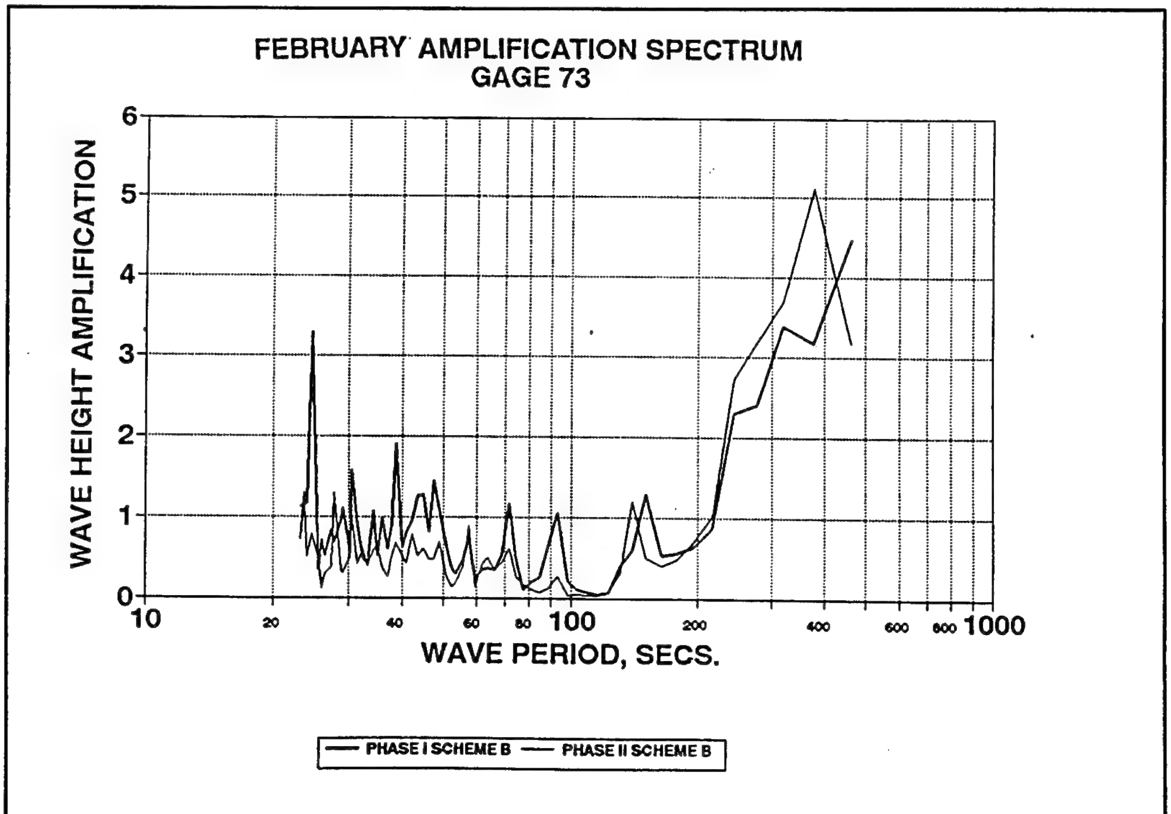


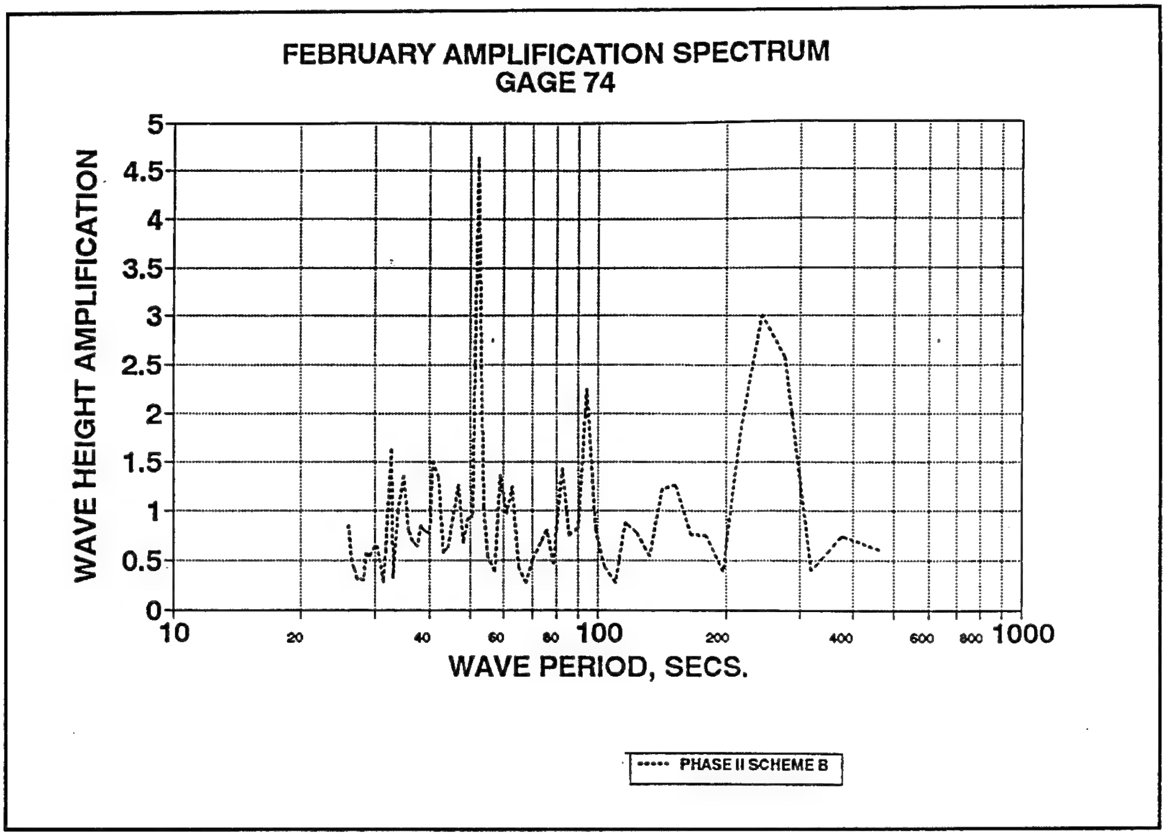
FEBRUARY AMPLIFICATION SPECTRUM
GAGE 70
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
0
0.5
1
1.5
2
2.5
3
3.5
4
10
20
40
60
80
100
200
400
600
800
1000
PHASE I SCHEME B
PHASE II SCHEME B

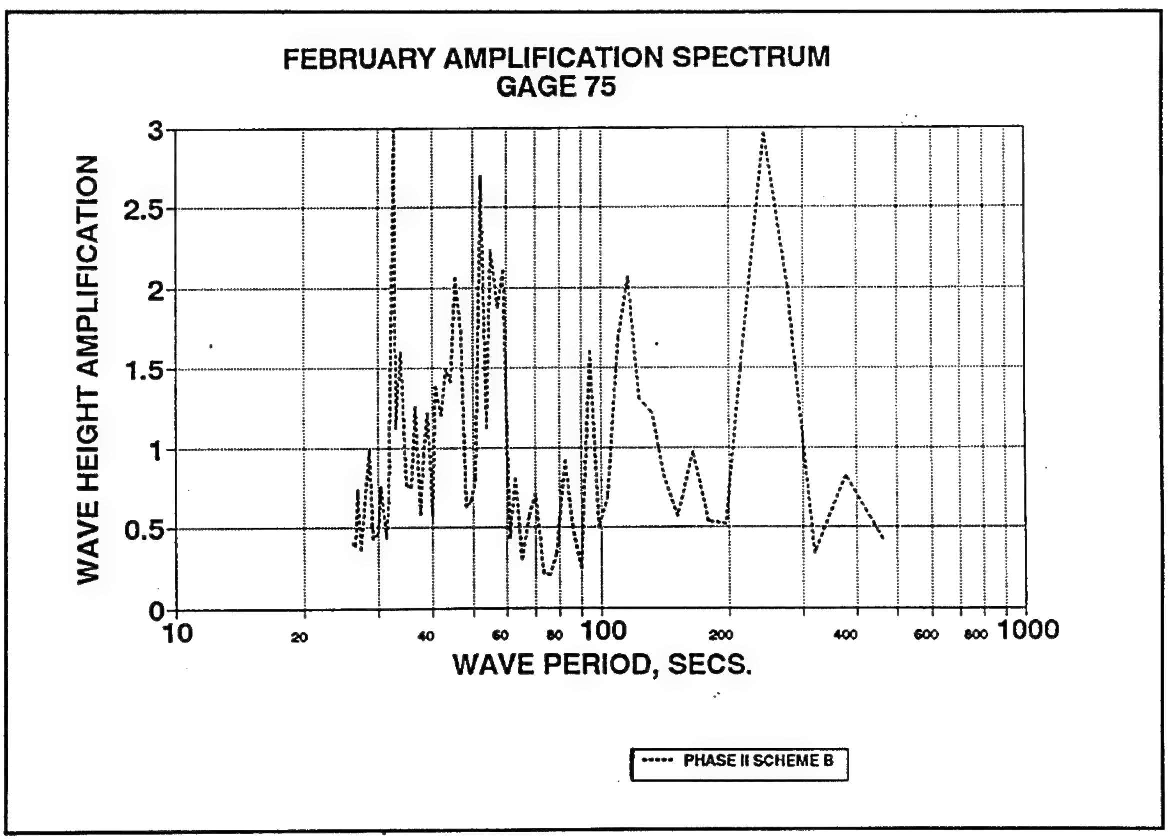



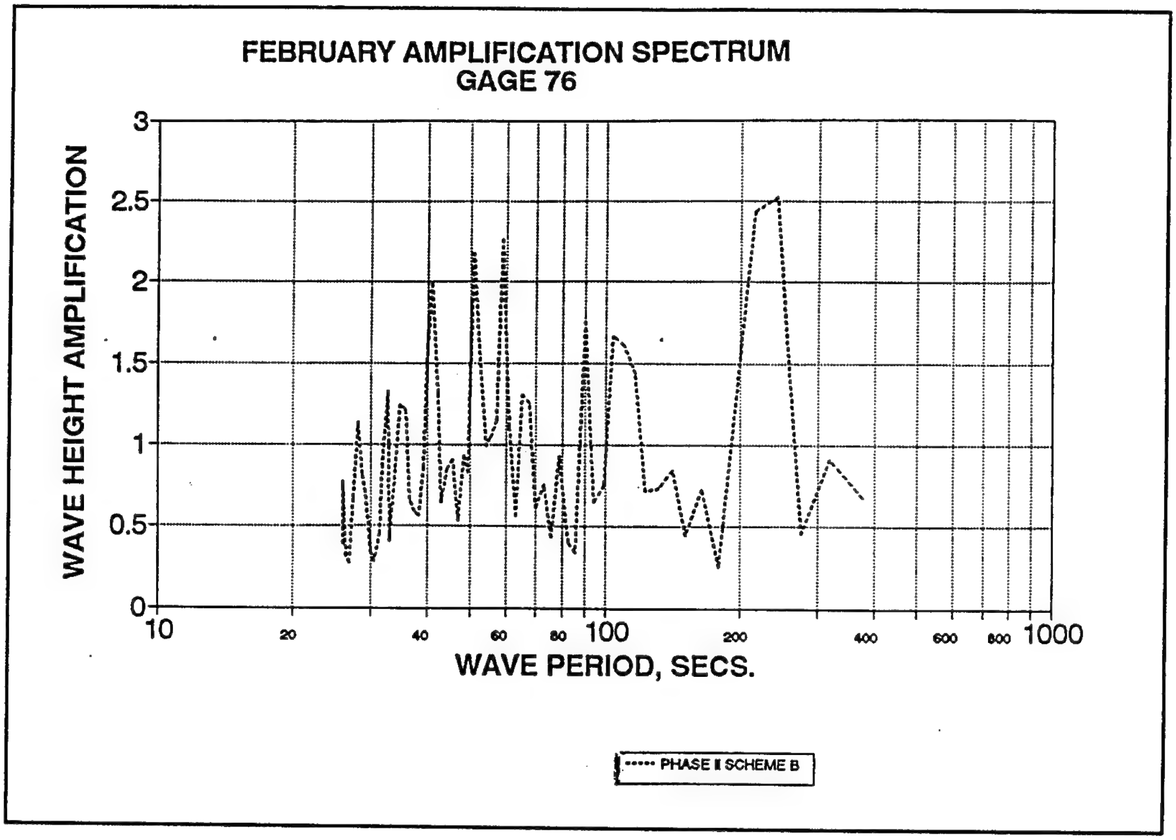
FEBRUARY AMPLIFICATION SPECTRUM
GAGE 71
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
0
0.5
1
1.5
2
2.5
3
3.5
10
20
40
60
80
100
200
400
600
800
1000
PHASE I SCHEME B
PHASE II SCHEME B

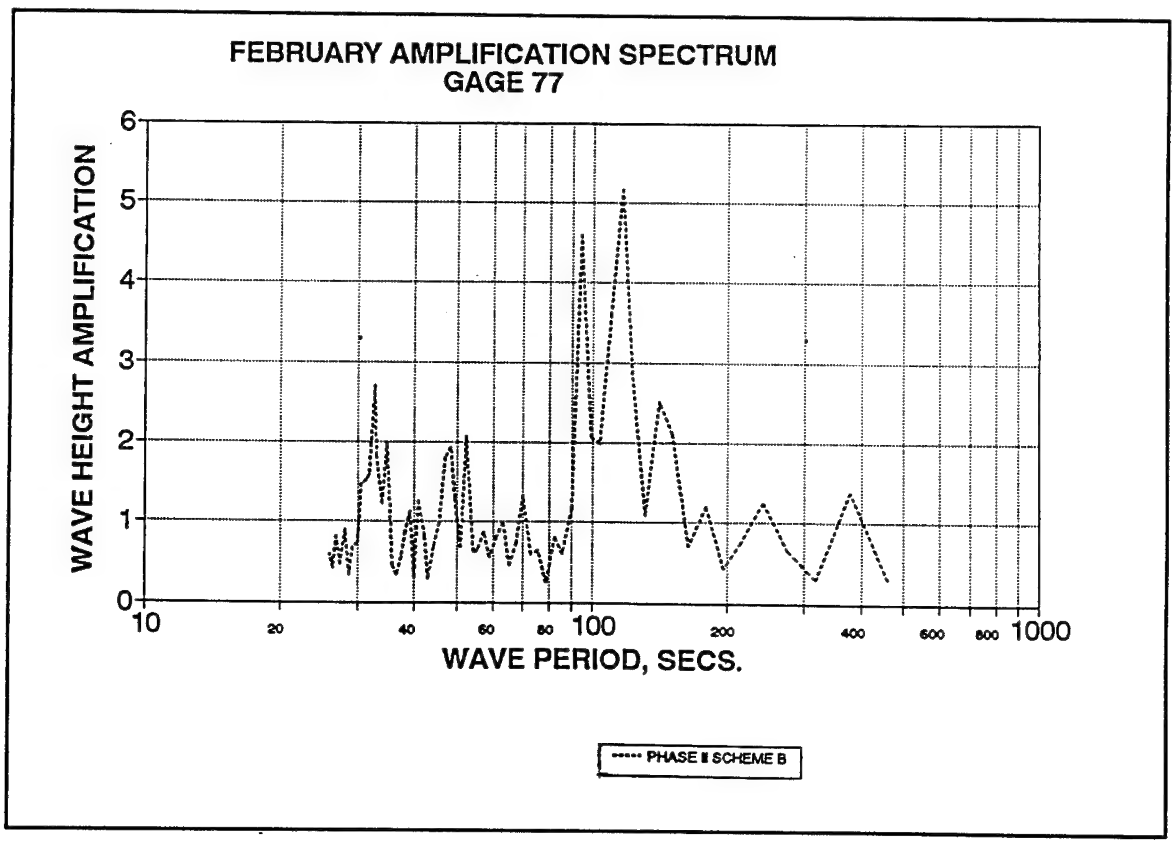

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 72
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

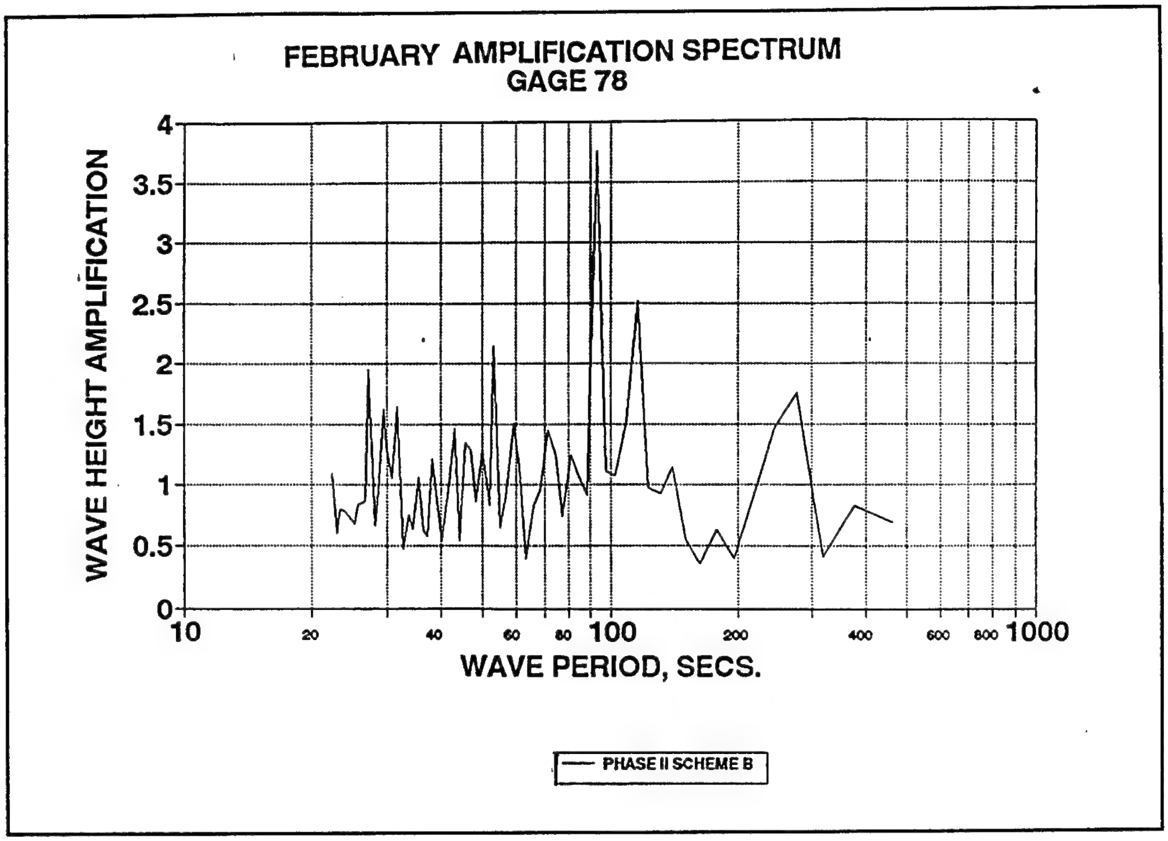

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 73
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

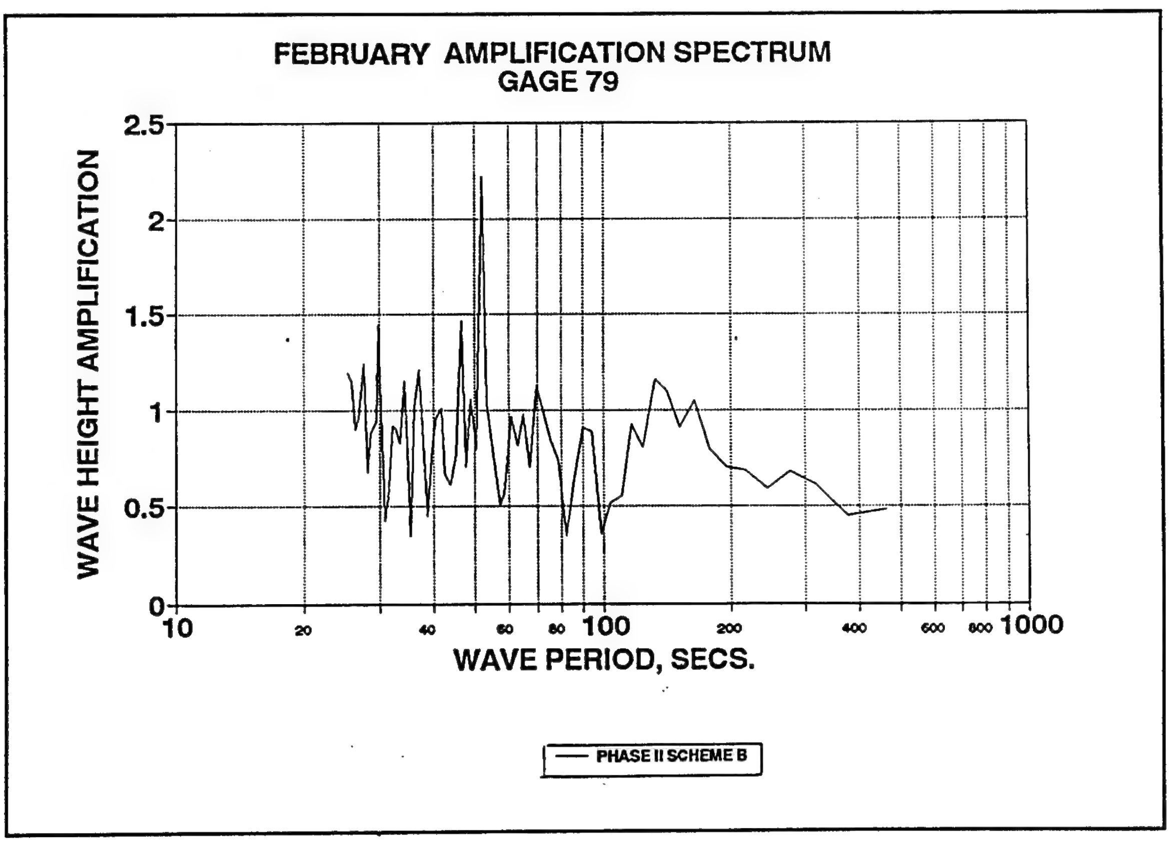

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 74
WAVE HEIGHT AMPLIFICATION
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B

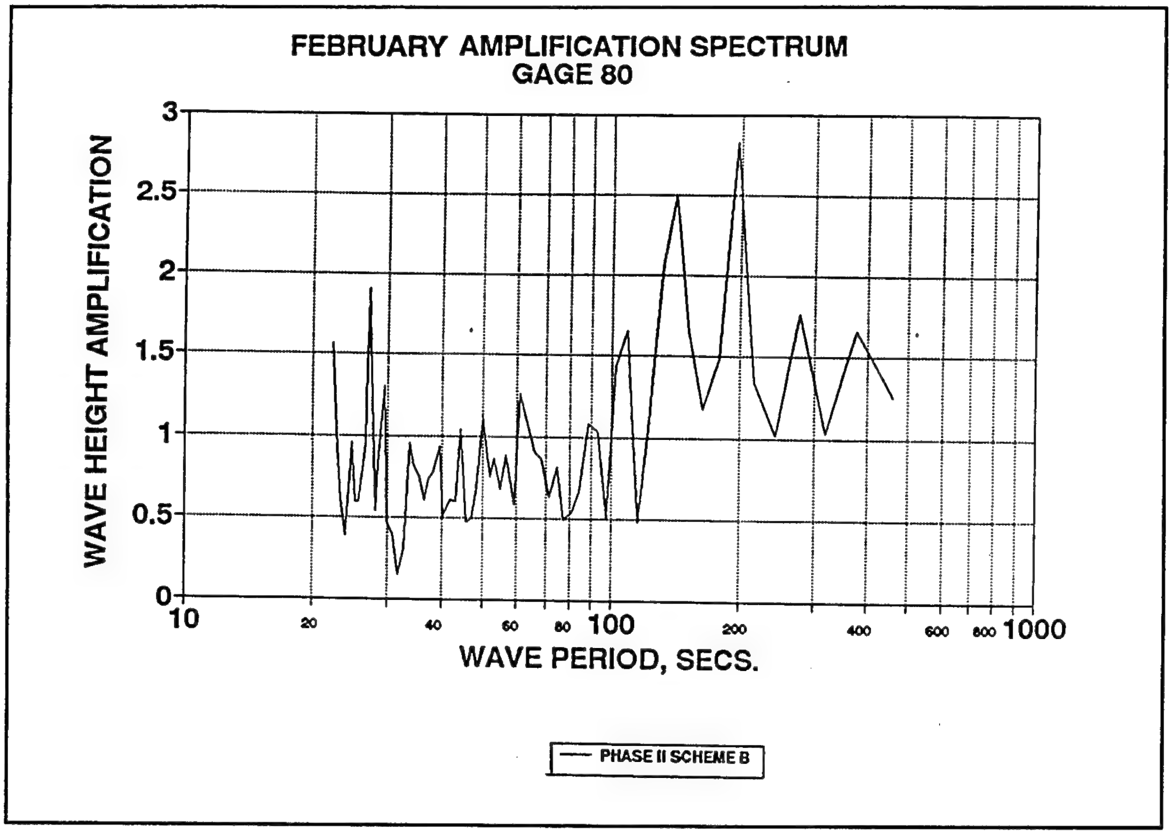

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 75
WAVE HEIGHT AMPLIFICATION
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B


FEBRUARY AMPLIFICATION SPECTRUM
GAGE 76
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B

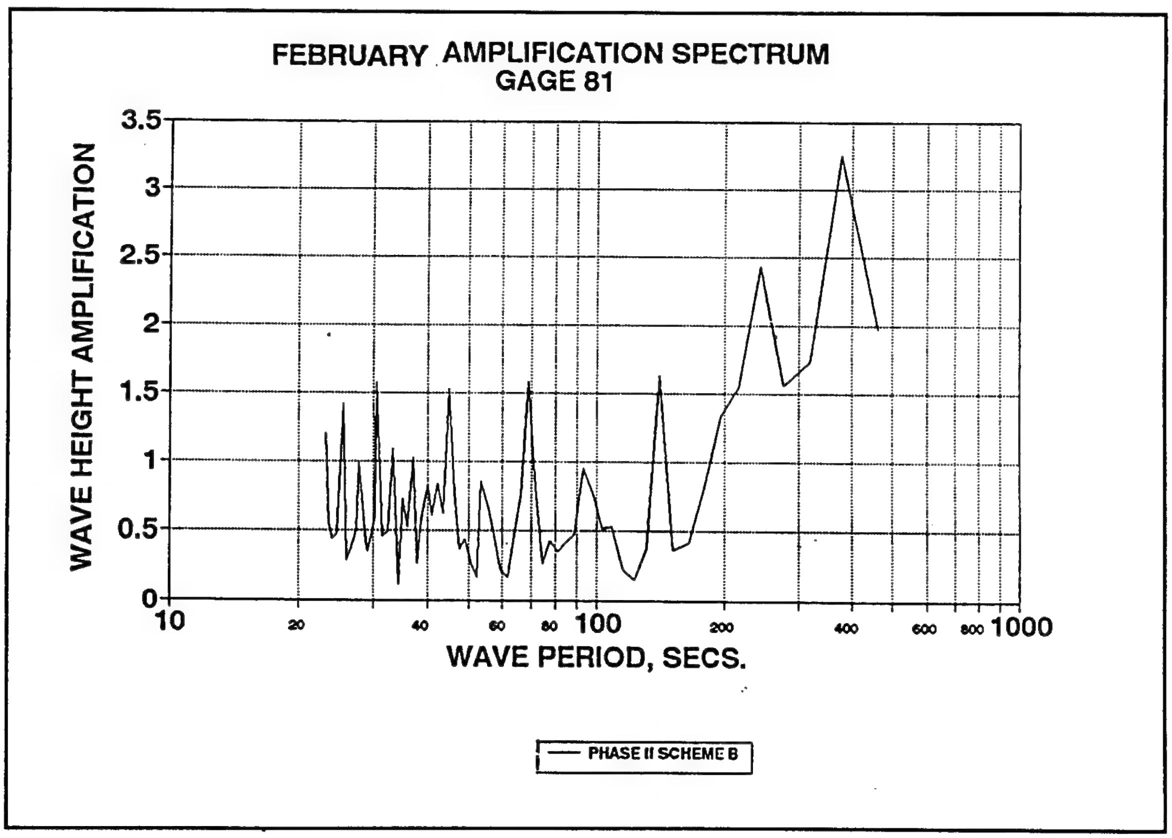

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 77
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B


FEBRUARY AMPLIFICATION SPECTRUM
GAGE 78
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
0
0.5
1
1.5
2
2.5
3
3.5
4
10
20
40
60
80
100
200
400
600
800
1000
PHASE II SCHEME B

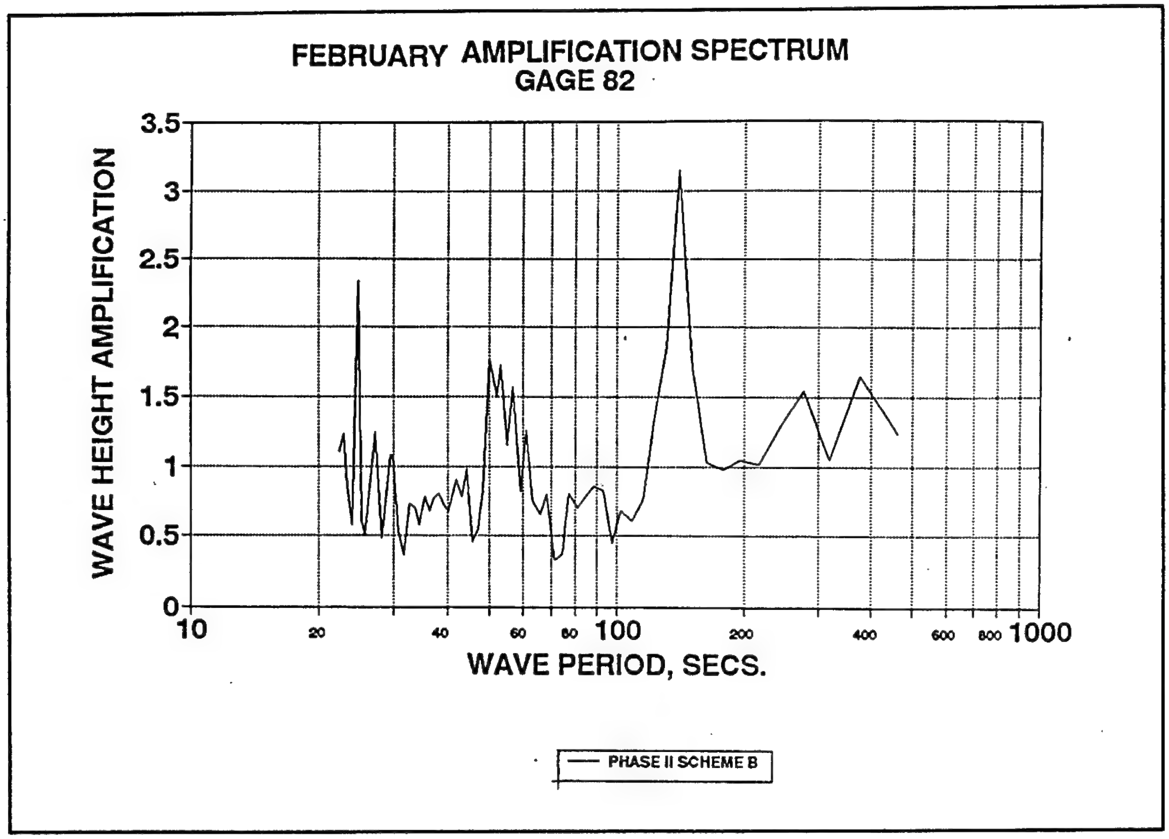

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 79
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
0
0.5
1
1.5
2
2.5
10
20
40
60
80
100
200
400
600
800
1000
PHASE II SCHEME B

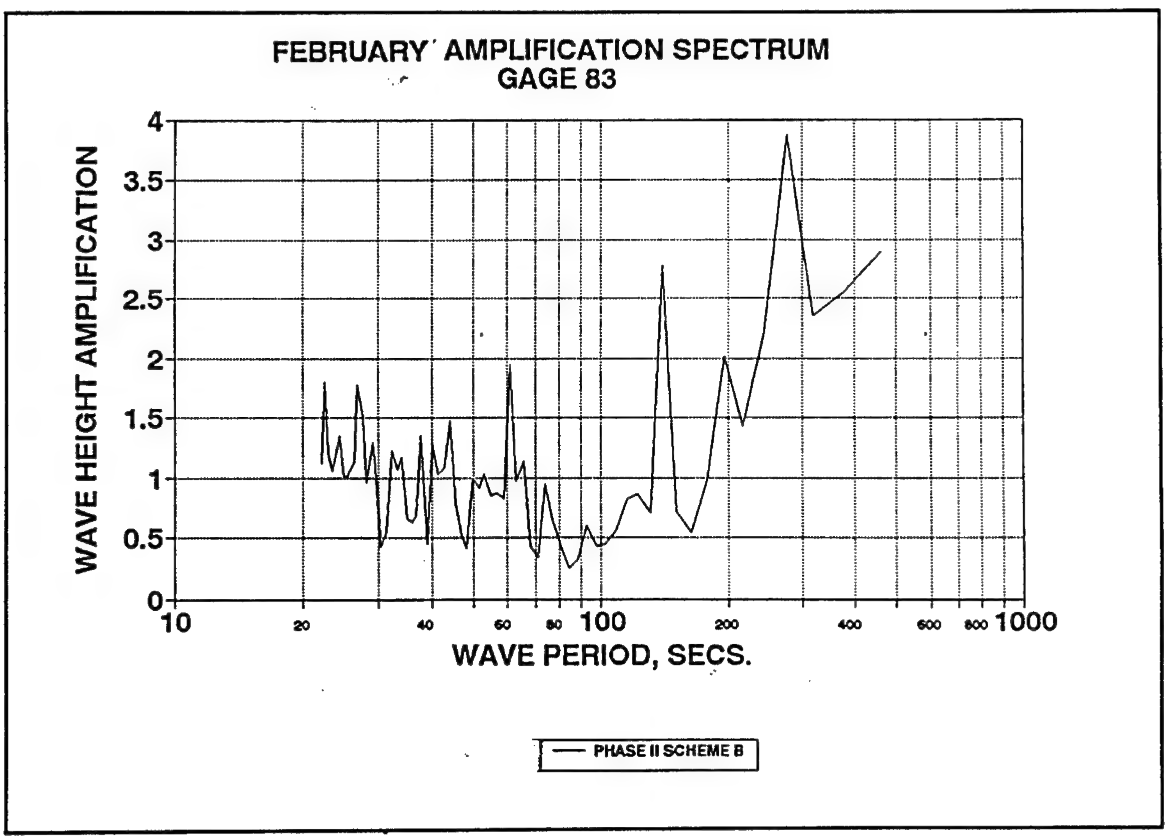


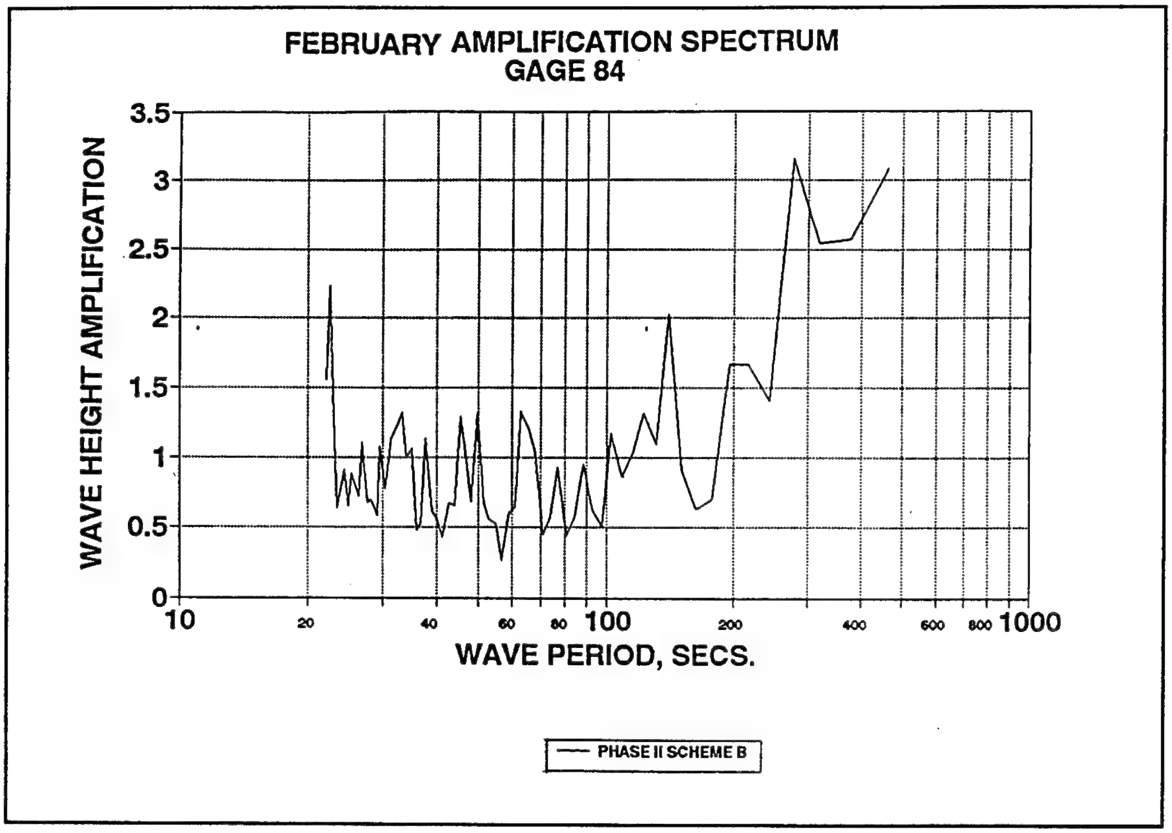
FEBRUARY AMPLIFICATION SPECTRUM
GAGE 80
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B

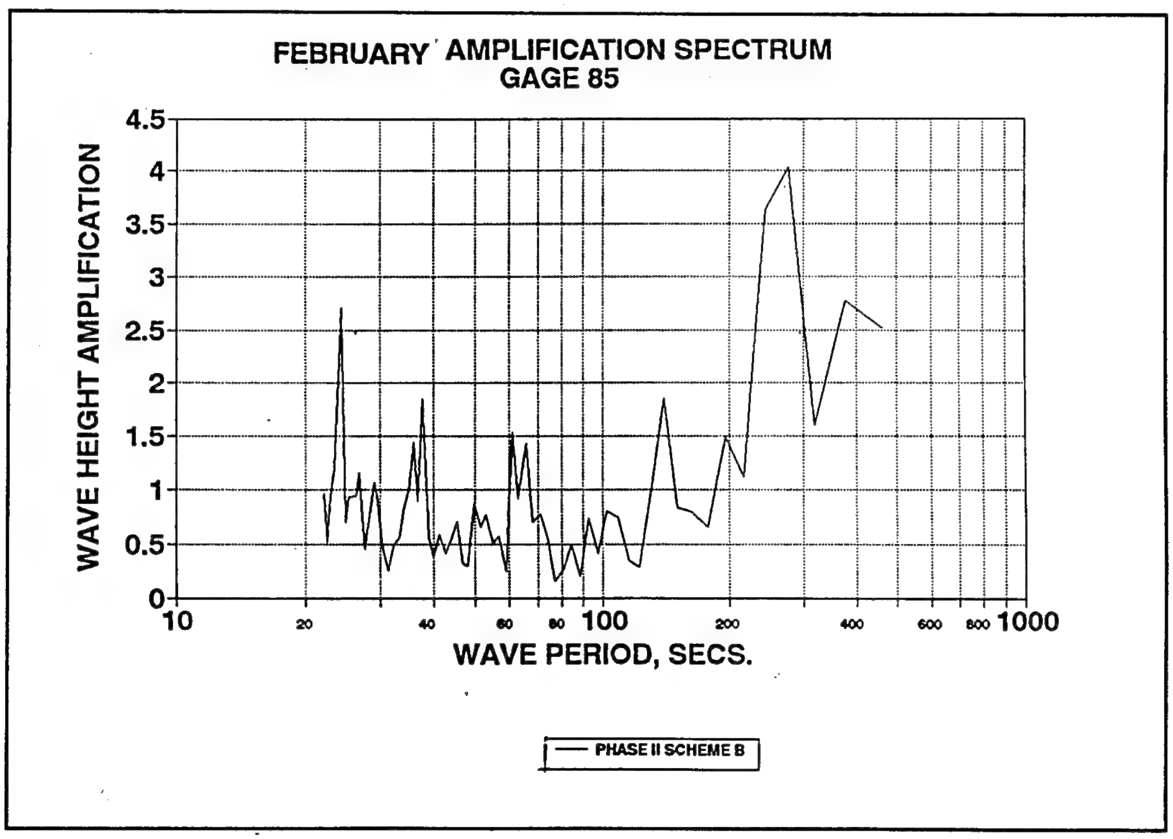



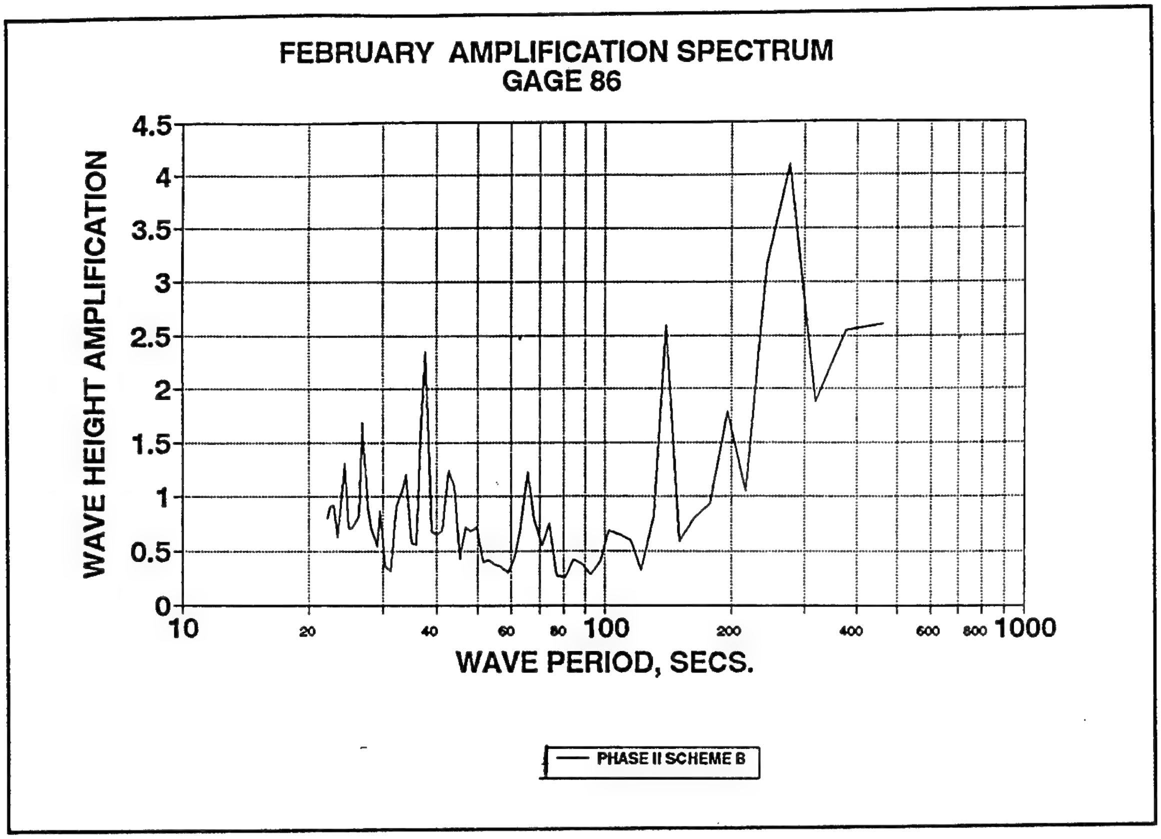
FEBRUARY AMPLIFICATION SPECTRUM
GAGE 81
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B


FEBRUARY AMPLIFICATION SPECTRUM
GAGE 82
WAVE HEIGHT AMPLIFICATION
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B

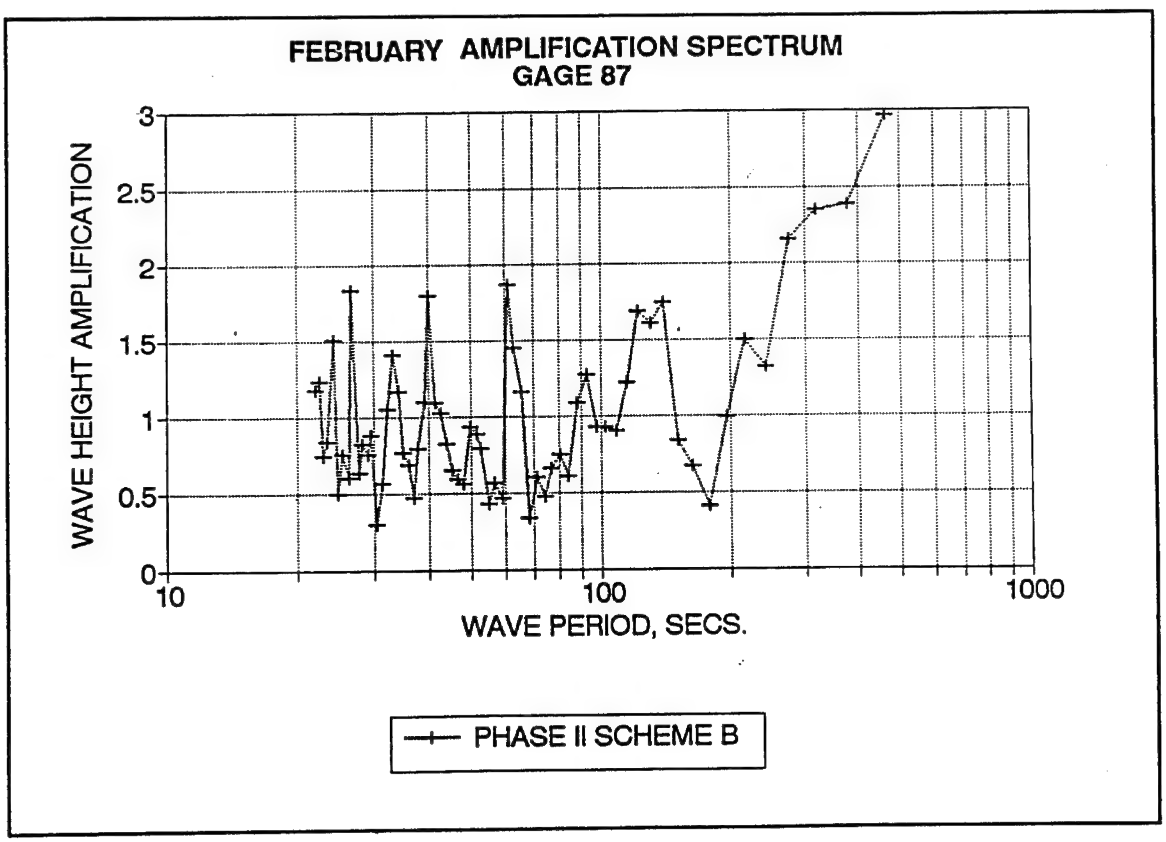

FEBRUARY AMPLIFICATION SPECTRUM
GAGE 83
WAVE HEIGHT AMPLIFICATION
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B


FEBRUARY AMPLIFICATION SPECTRUM
GAGE 84
WAVE HEIGHT AMPLIFICATION
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B


FEBRUARY AMPLIFICATION SPECTRUM
GAGE 85
WAVE HEIGHT AMPLIFICATION
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B

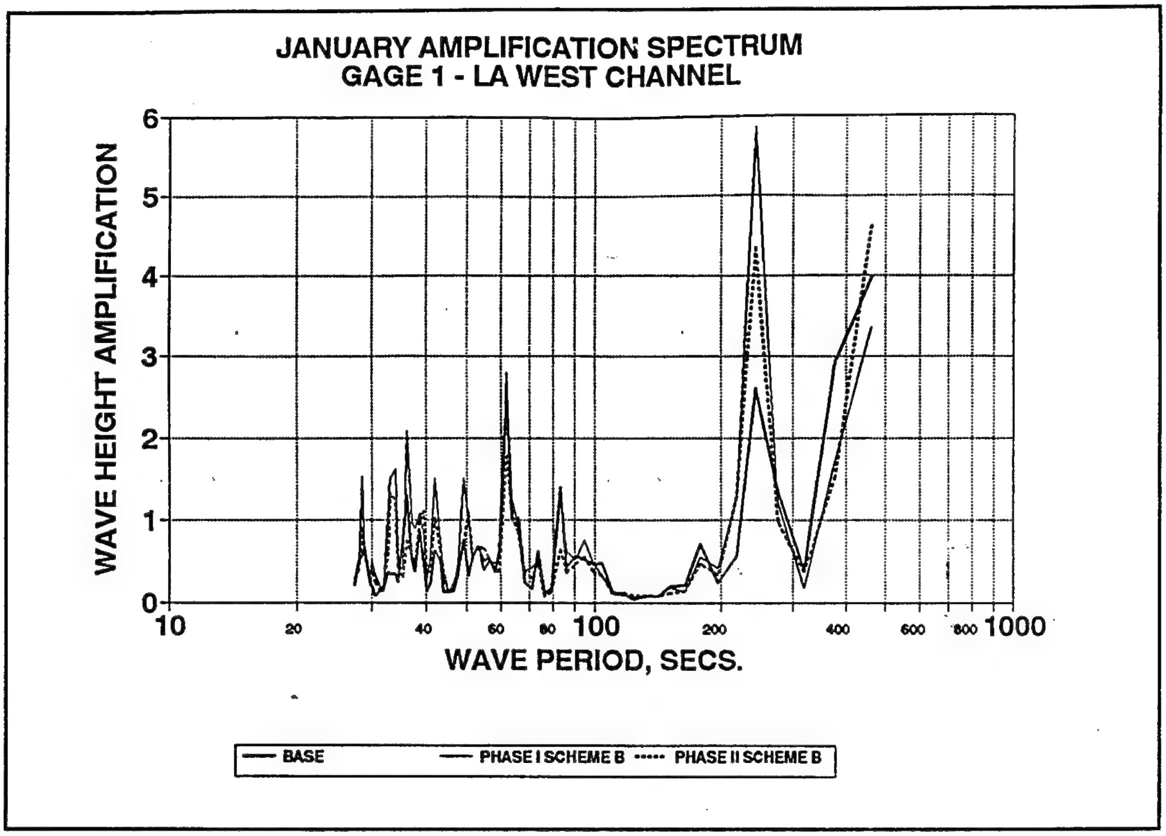


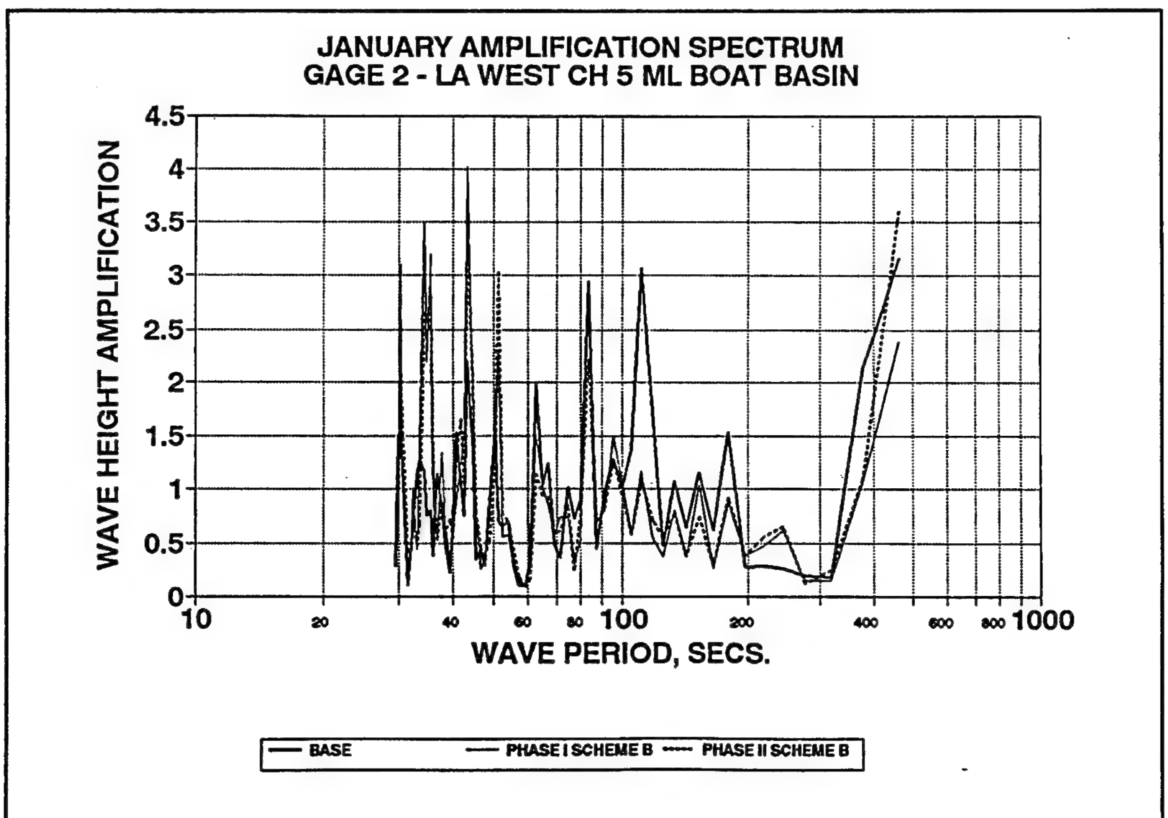
FEBRUARY AMPLIFICATION SPECTRUM
GAGE 86
WAVE HEIGHT AMPLIFICATION
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B

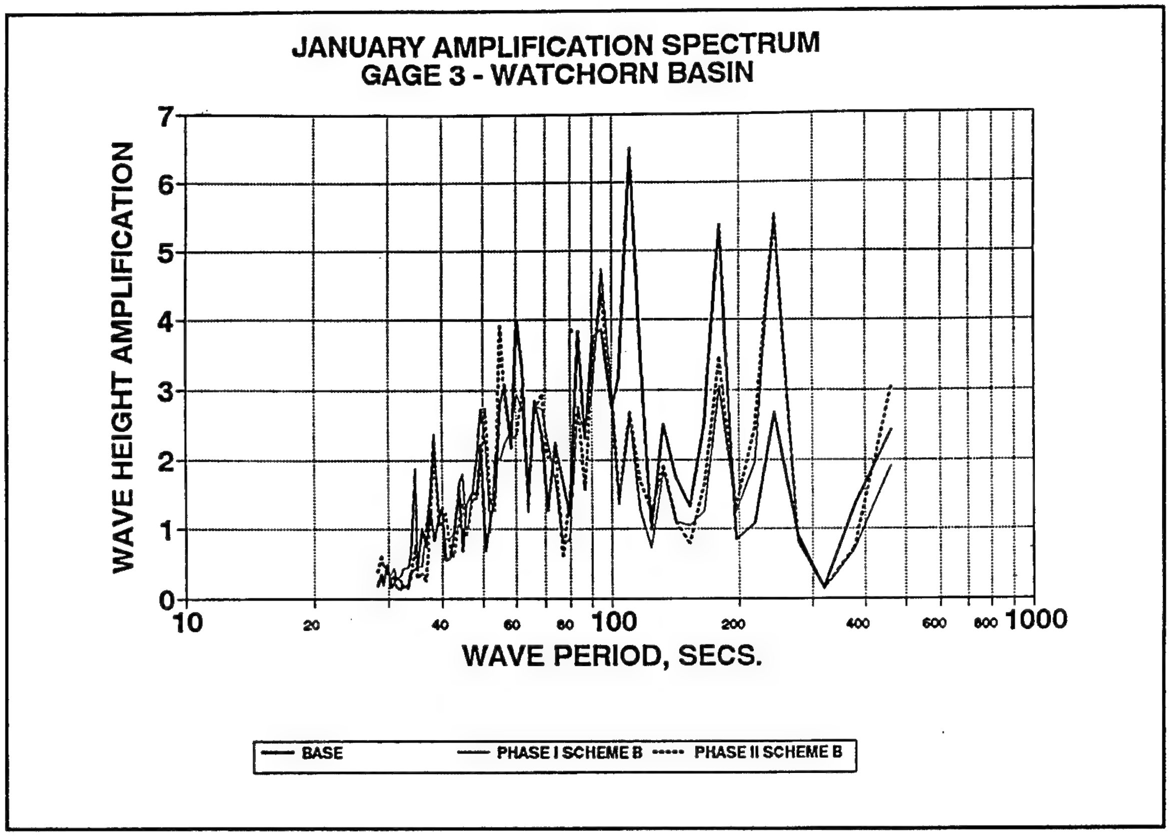



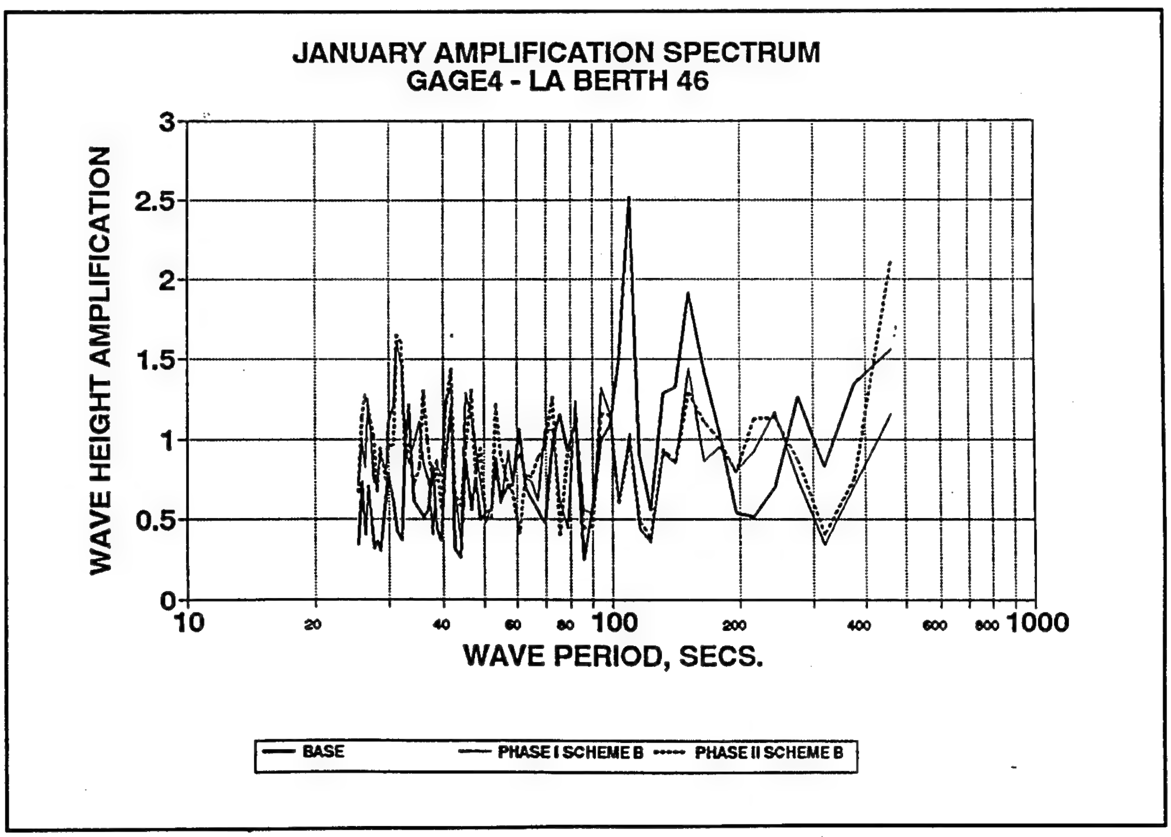
FEBRUARY AMPLIFICATION SPECTRUM
GAGE 87
WAVE HEIGHT AMPLIFICATION
3
2.5
2
1.5
1
0.5
0
10
100
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B

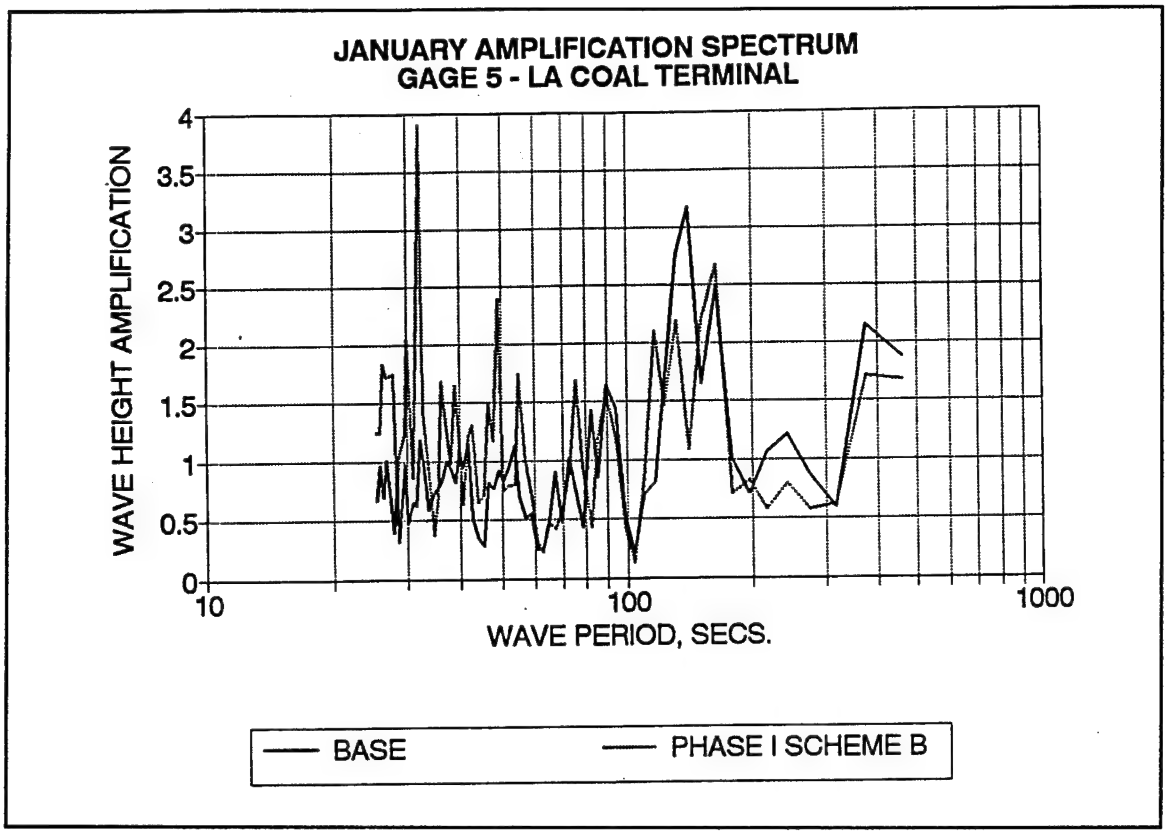
# Appendix D
# January Spectrum Test Results (Phases I and II, Scheme B)

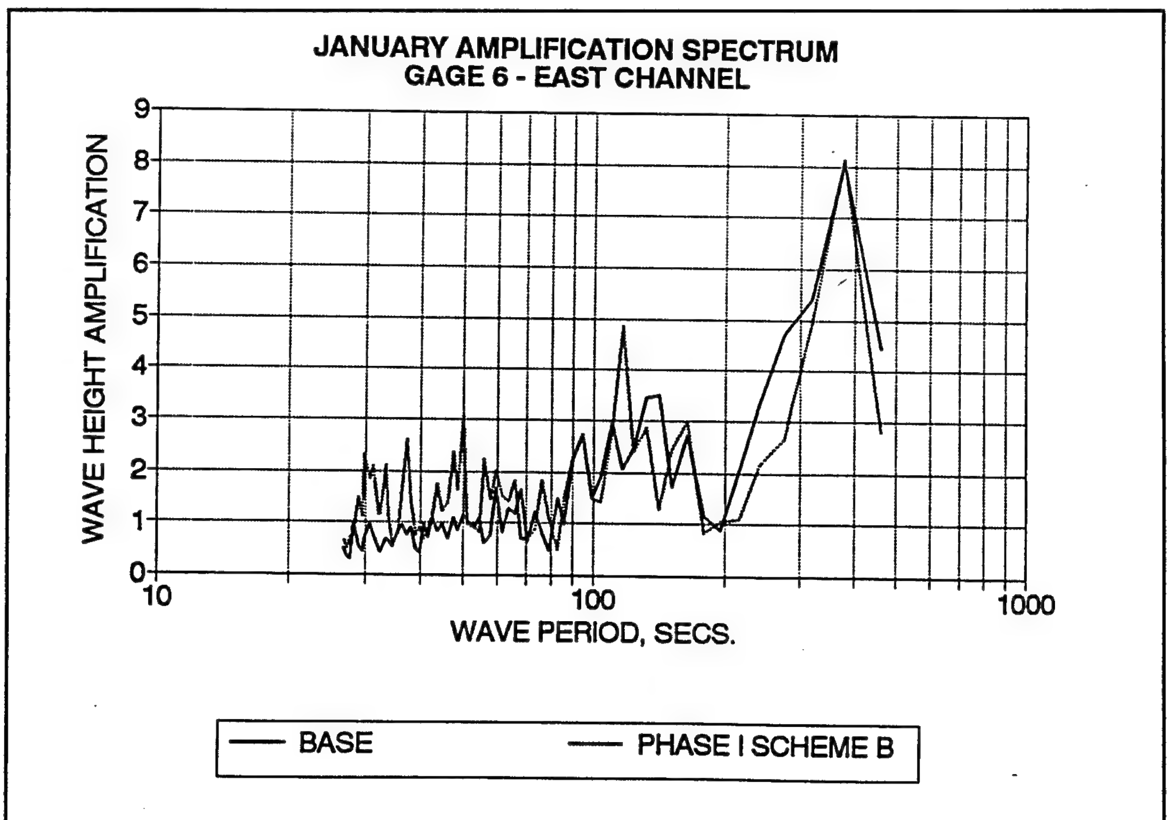

JANUARY AMPLIFICATION SPECTRUM
GAGE 1 - LA WEST CHANNEL
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
0
1
2
3
4
5
6
10
20
40
60
80
100
200
400
600
800
1000
BASE
PHASE I SCHEME B
PHASE II SCHEME B

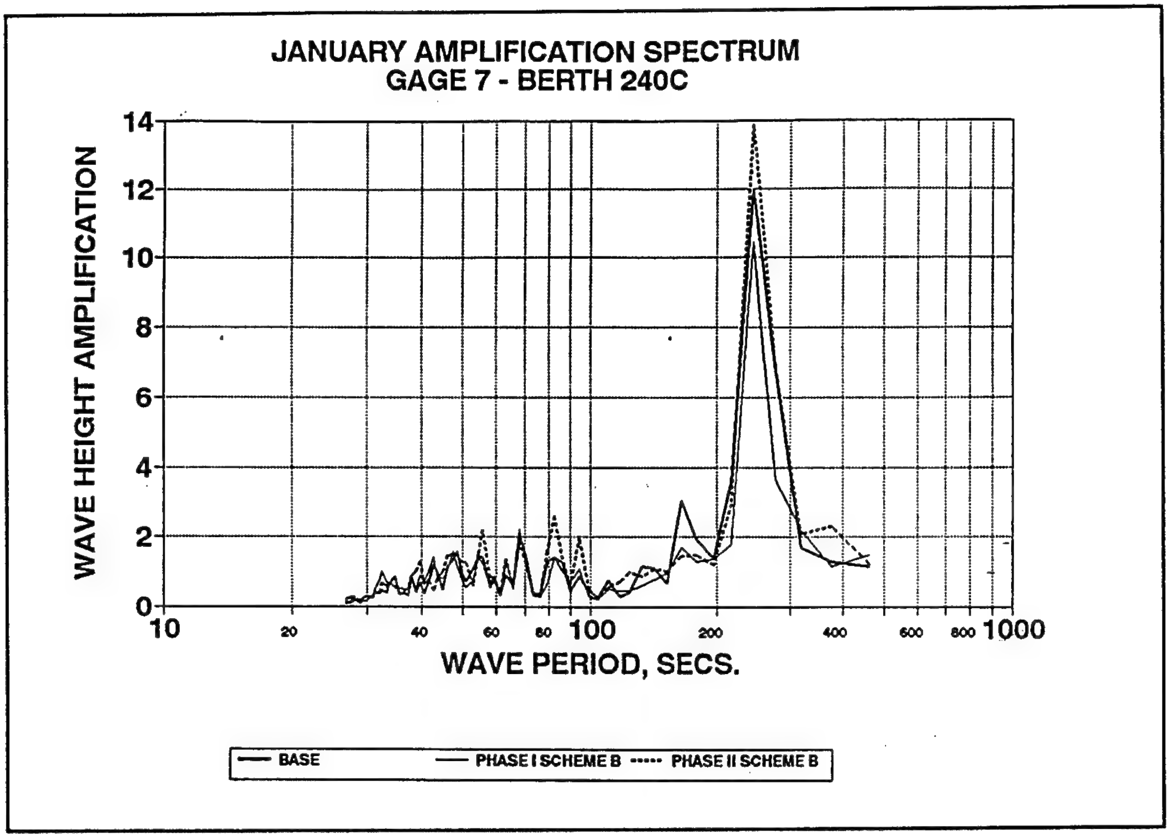

JANUARY AMPLIFICATION SPECTRUM
GAGE 2 - LA WEST CH 5 ML BOAT BASIN
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
10
20
40
60
80
100
200
400
600
800
1000
BASE
PHASE I SCHEME B
PHASE II SCHEME B


JANUARY AMPLIFICATION SPECTRUM
GAGE 3 - WATCHORN BASIN
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
7
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

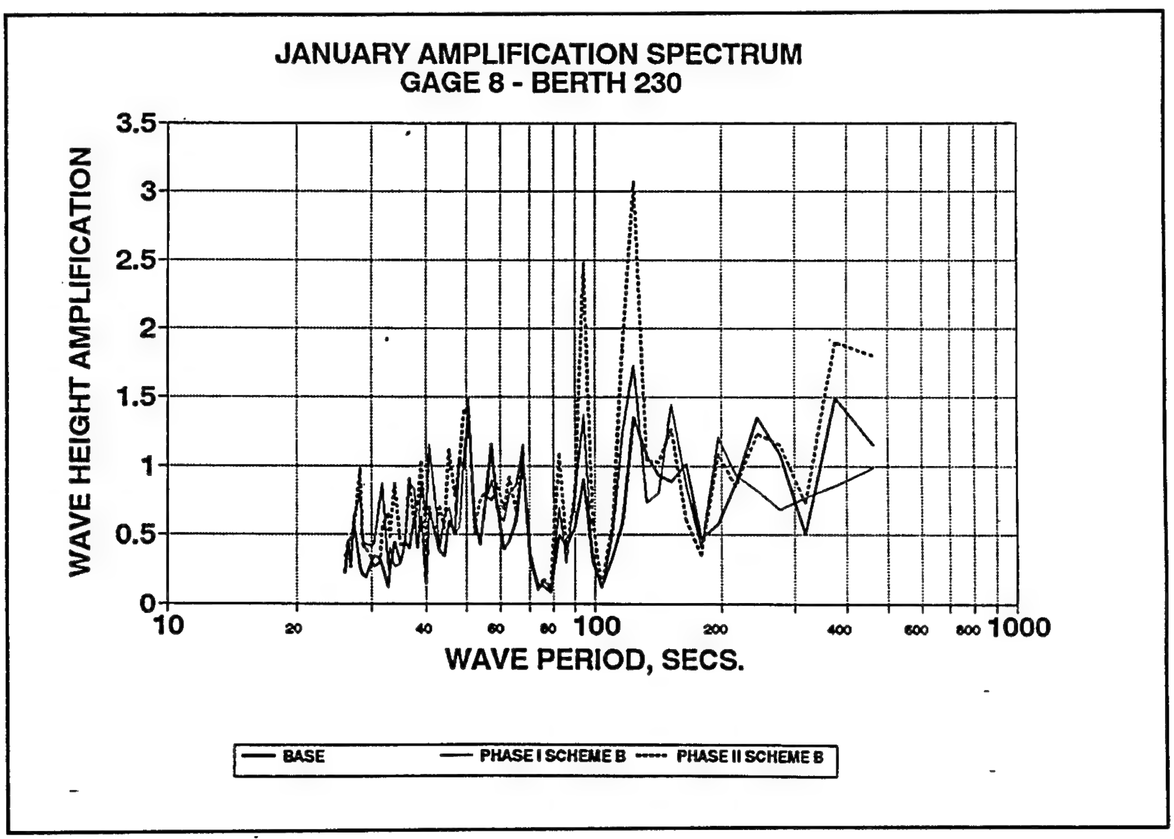

JANUARY AMPLIFICATION SPECTRUM
GAGE4 - LA BERTH 46
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B


JANUARY AMPLIFICATION SPECTRUM
GAGE 5 - LA COAL TERMINAL
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
4
10
100
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B

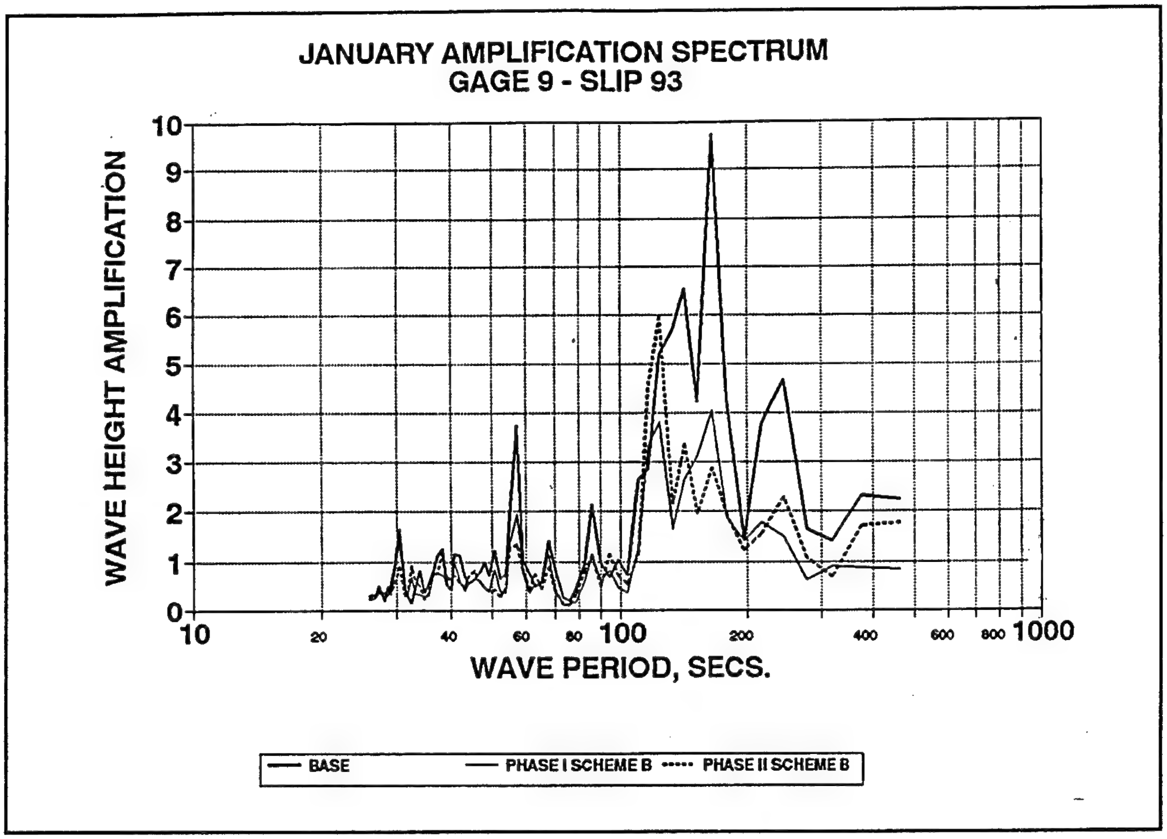

JANUARY AMPLIFICATION SPECTRUM
GAGE 6 - EAST CHANNEL
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
7
8
9
10
100
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B

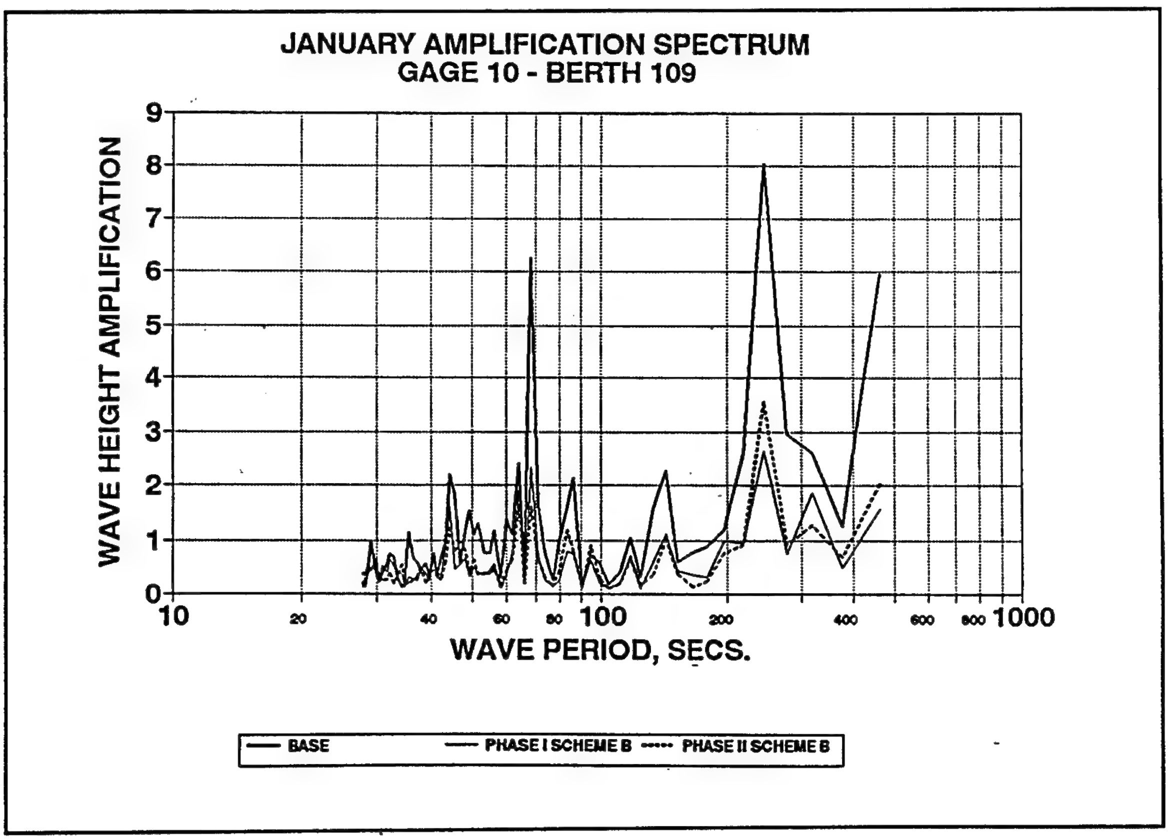


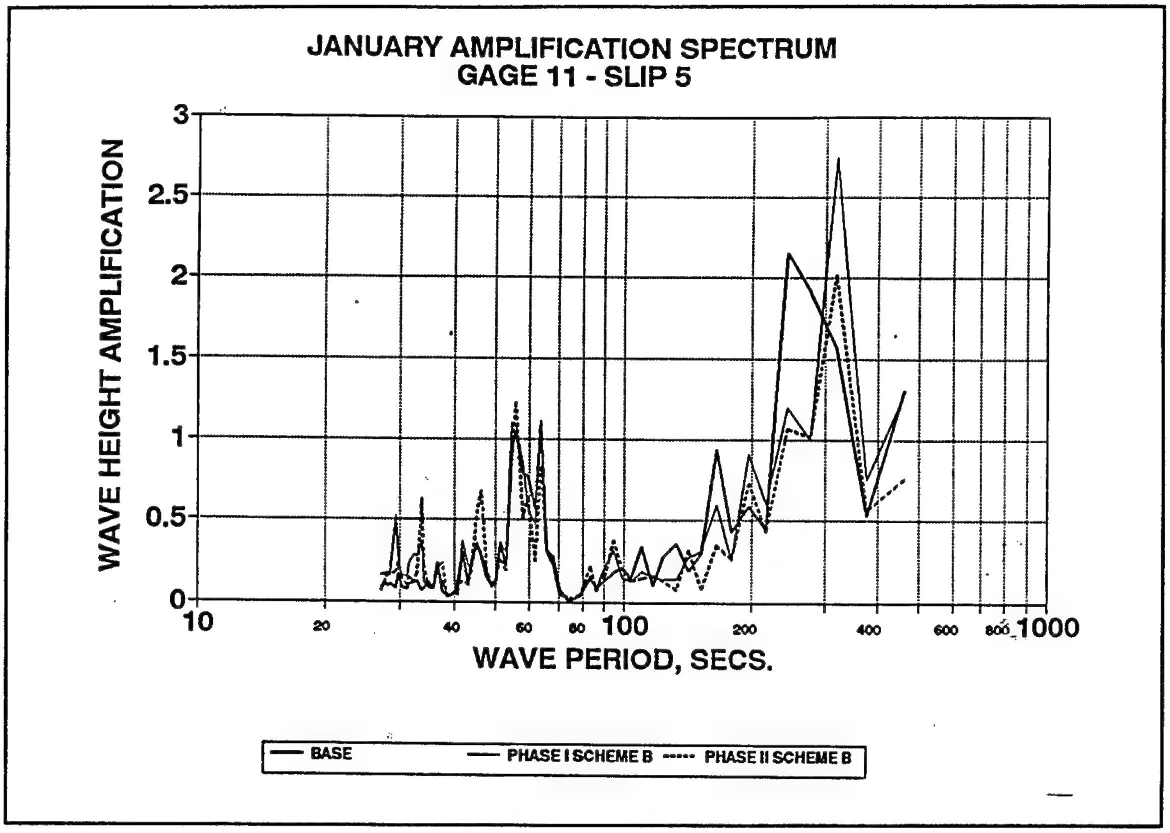
JANUARY AMPLIFICATION SPECTRUM
GAGE 7 - BERTH 240C
WAVE HEIGHT AMPLIFICATION
0
2
4
6
8
10
12
14
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

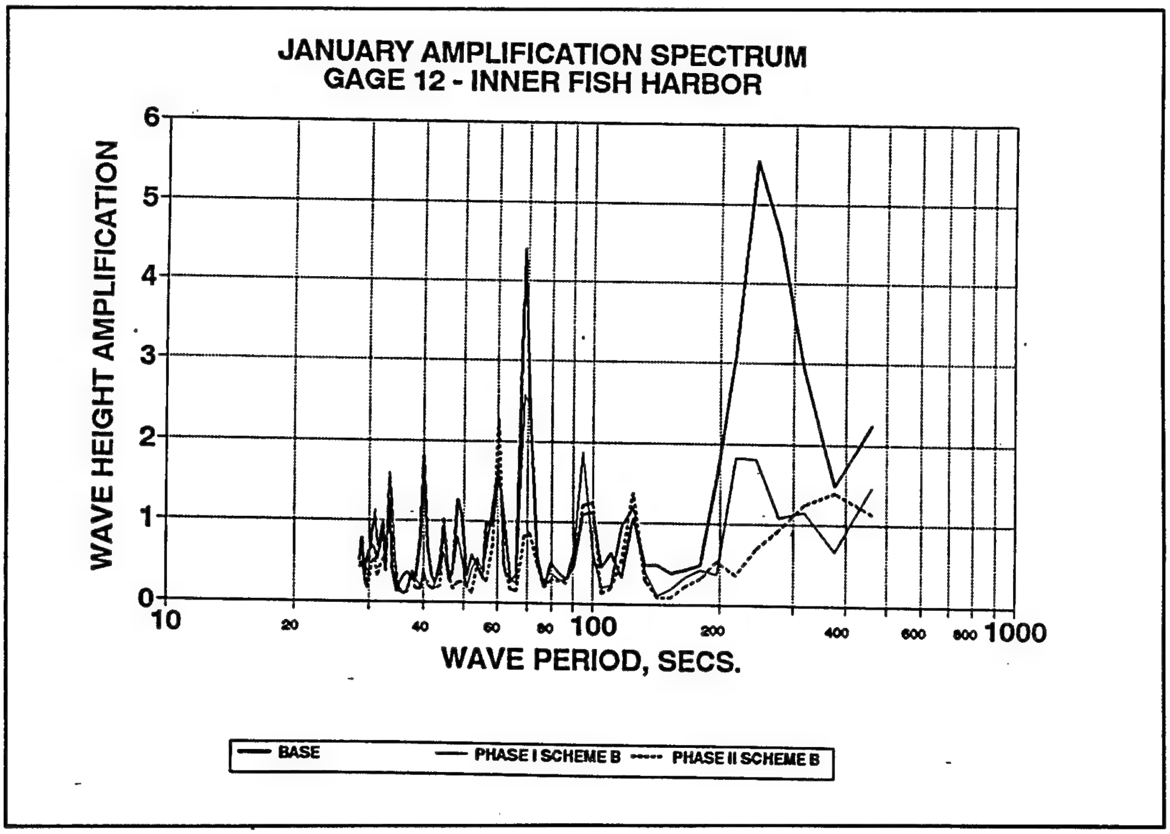



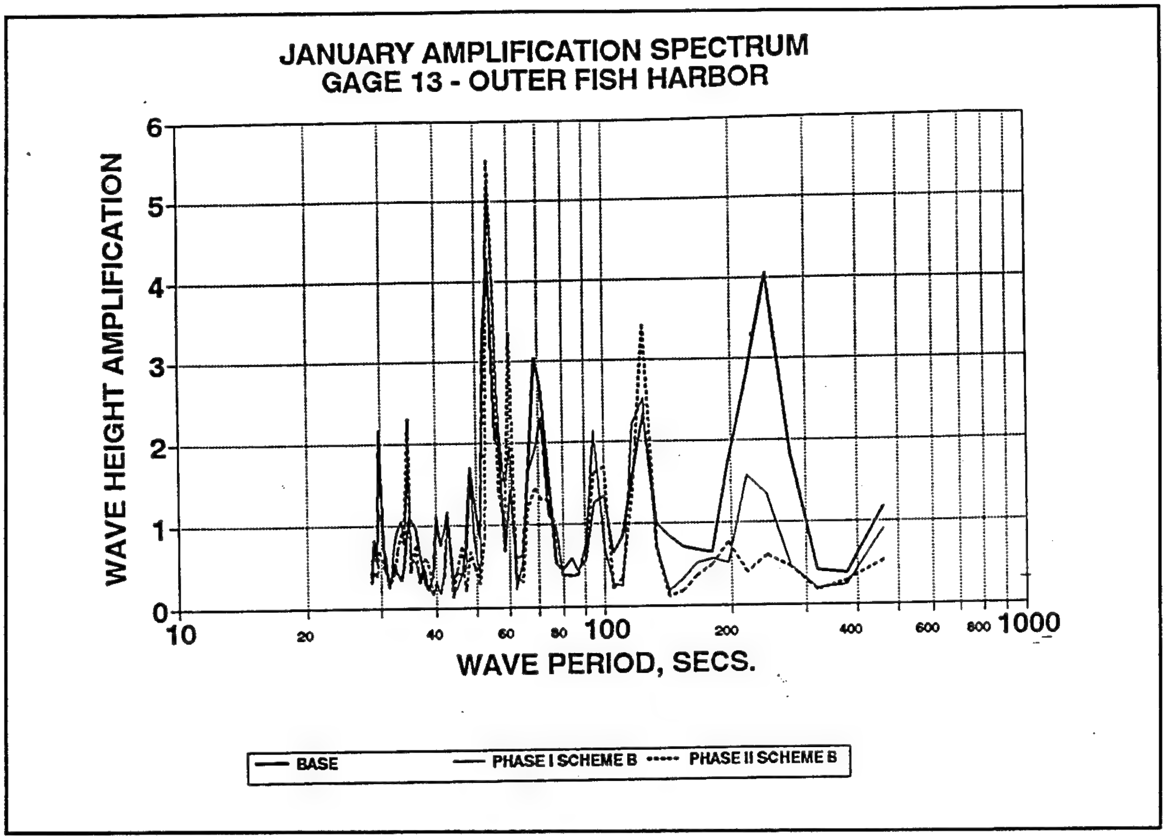
JANUARY AMPLIFICATION SPECTRUM
GAGE 8 - BERTH 230
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

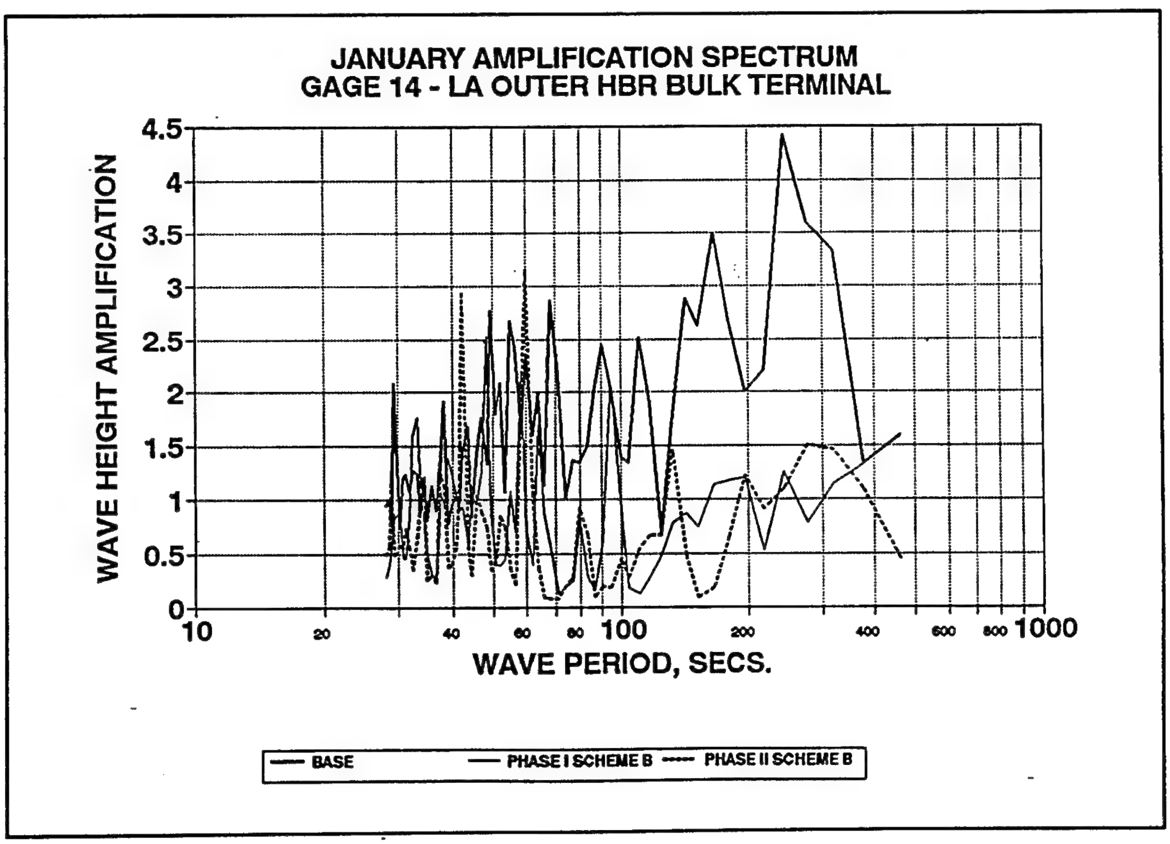

JANUARY AMPLIFICATION SPECTRUM
GAGE 9 - SLIP 93
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

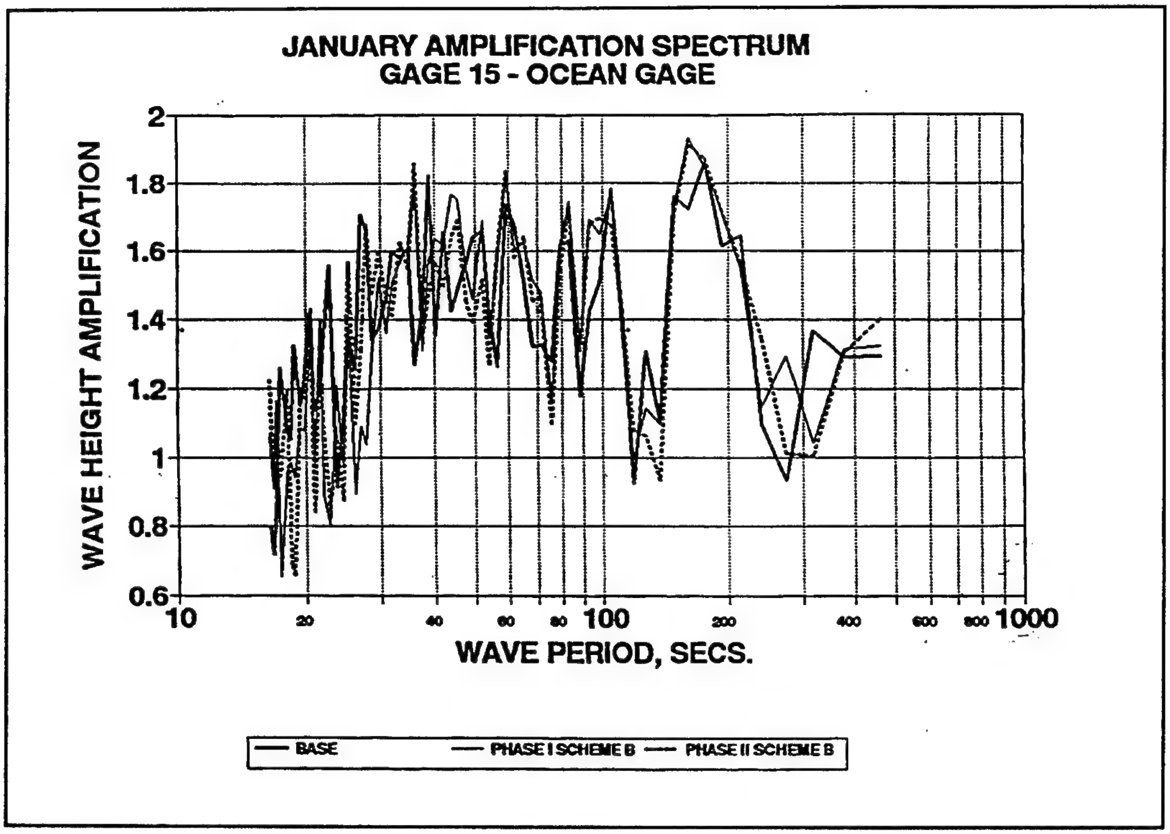

JANUARY AMPLIFICATION SPECTRUM
GAGE 10 - BERTH 109
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

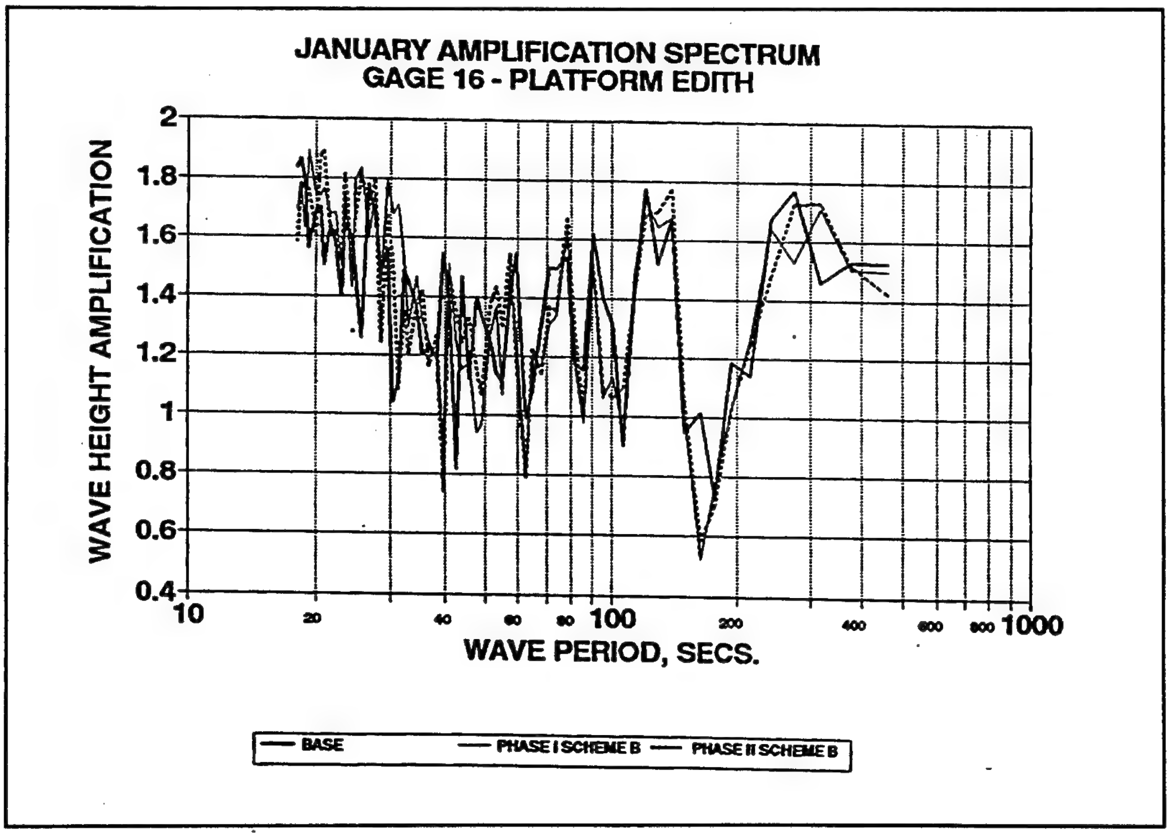

JANUARY AMPLIFICATION SPECTRUM
GAGE 11 - SLIP 5
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

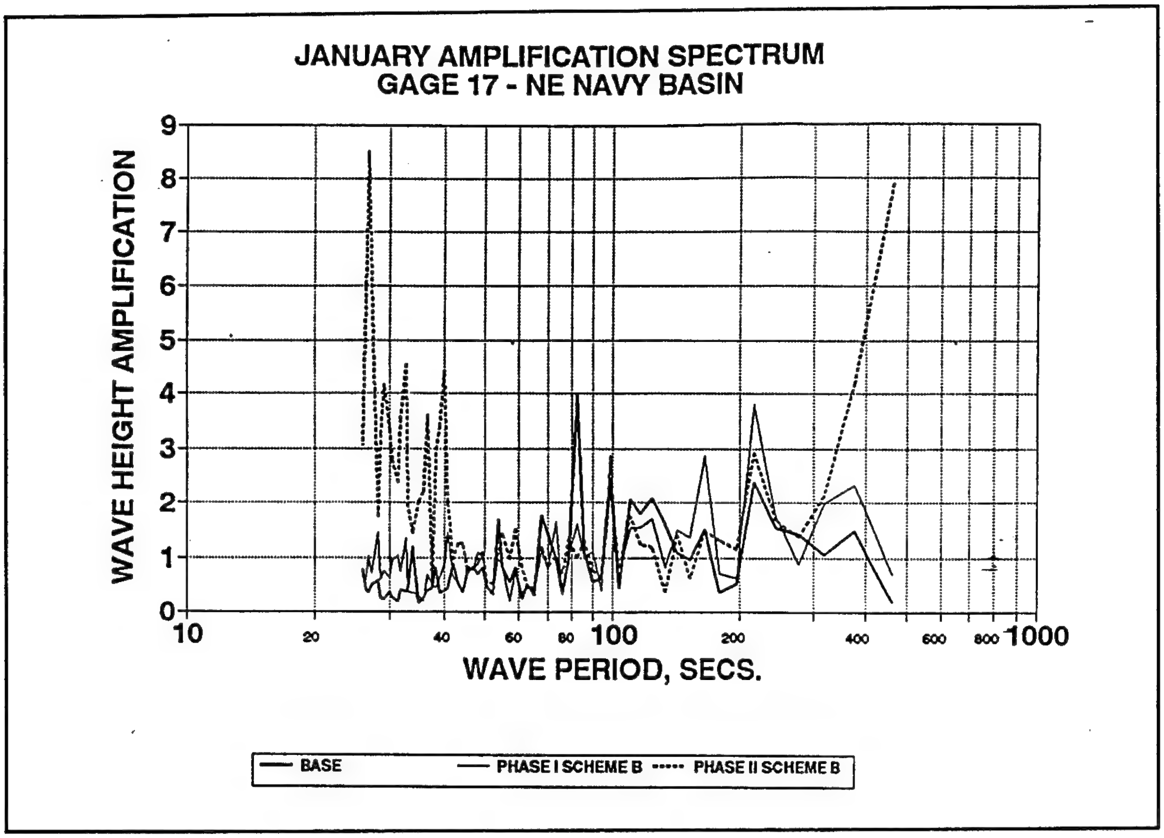

JANUARY AMPLIFICATION SPECTRUM
GAGE 12 - INNER FISH HARBOR
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B


JANUARY AMPLIFICATION SPECTRUM
GAGE 13 - OUTER FISH HARBOR
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

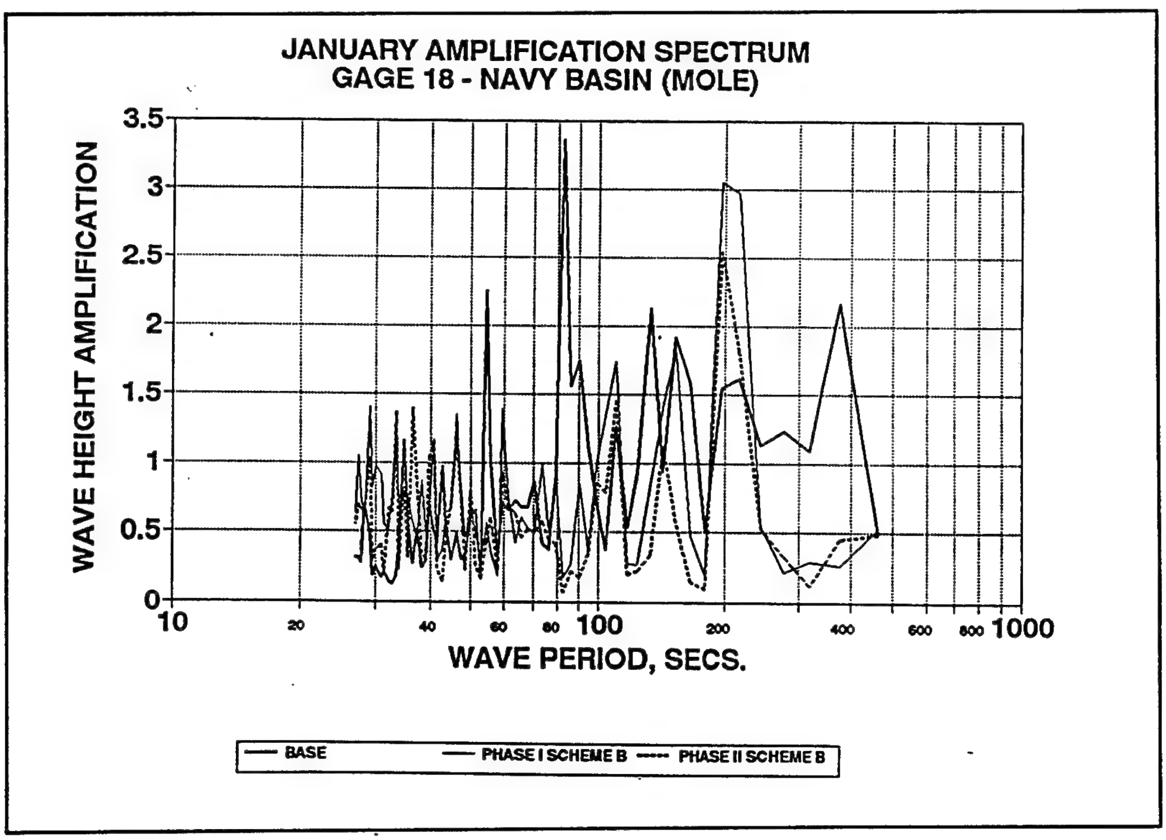

JANUARY AMPLIFICATION SPECTRUM
GAGE 14 - LA OUTER HBR BULK TERMINAL
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B


JANUARY AMPLIFICATION SPECTRUM
GAGE 15 - OCEAN GAGE
WAVE HEIGHT AMPLIFICATION
2
1.8
1.6
1.4
1.2
1
0.8
0.6
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

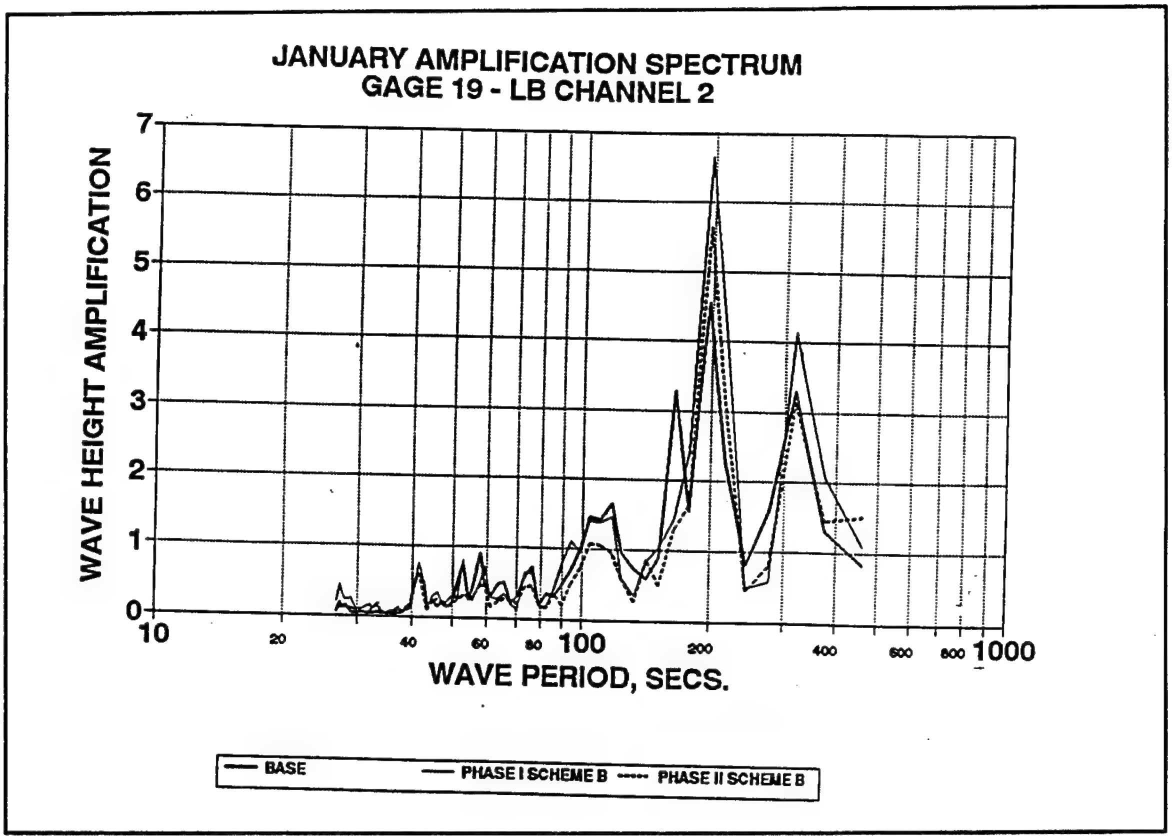

JANUARY AMPLIFICATION SPECTRUM
GAGE 16 - PLATFORM EDITH
WAVE HEIGHT AMPLIFICATION
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

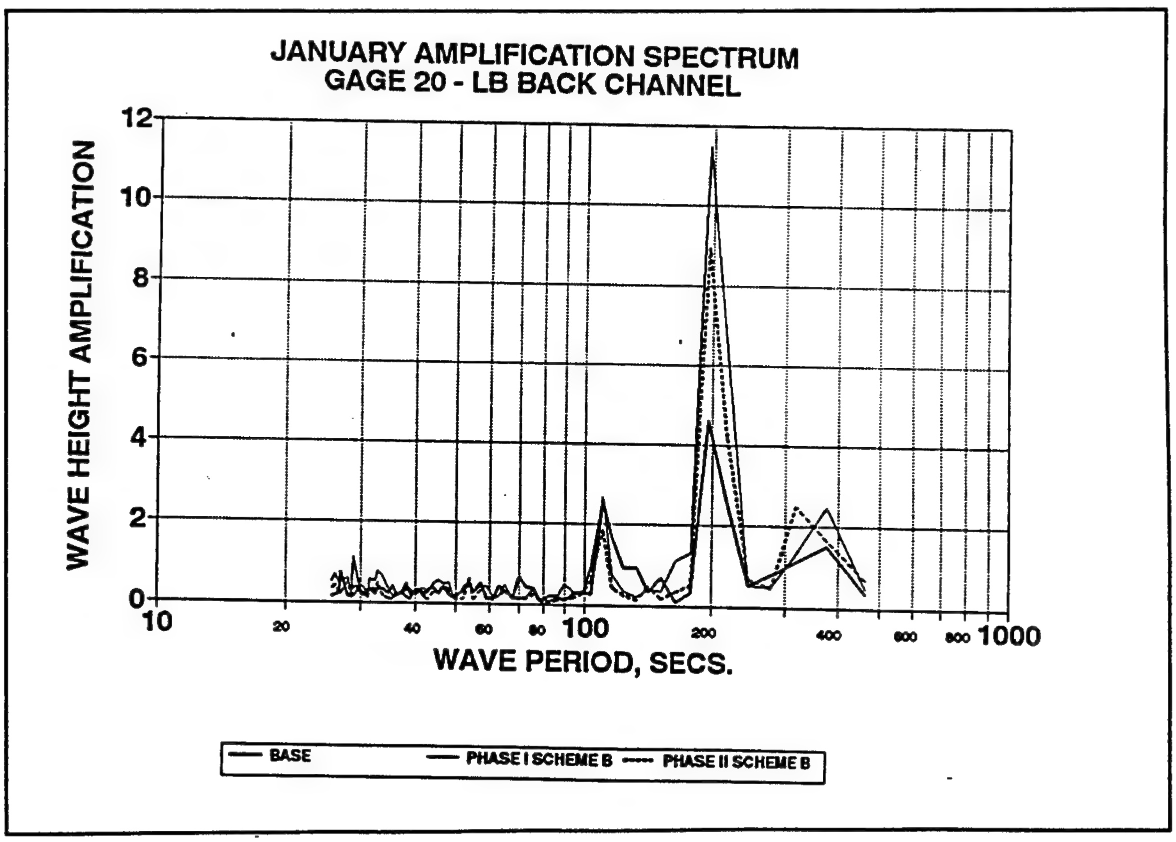


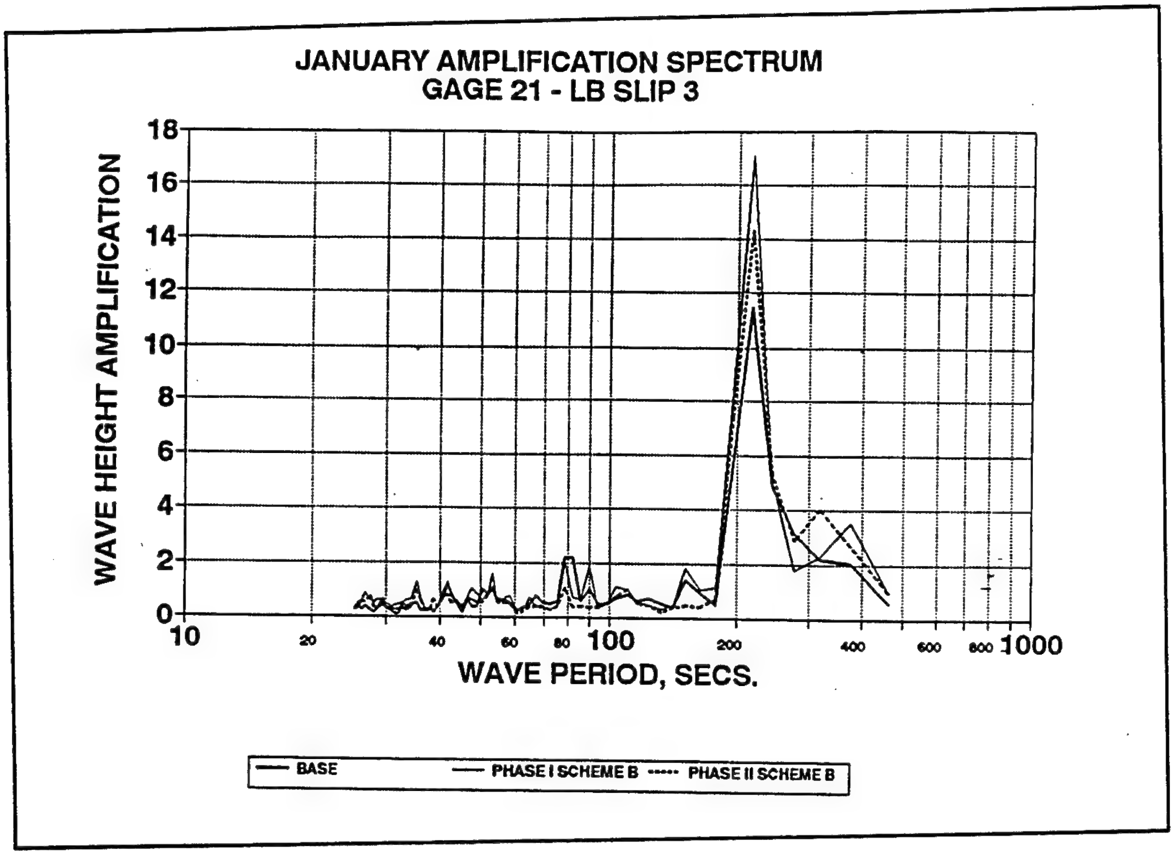
JANUARY AMPLIFICATION SPECTRUM
GAGE 17 - NE NAVY BASIN
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

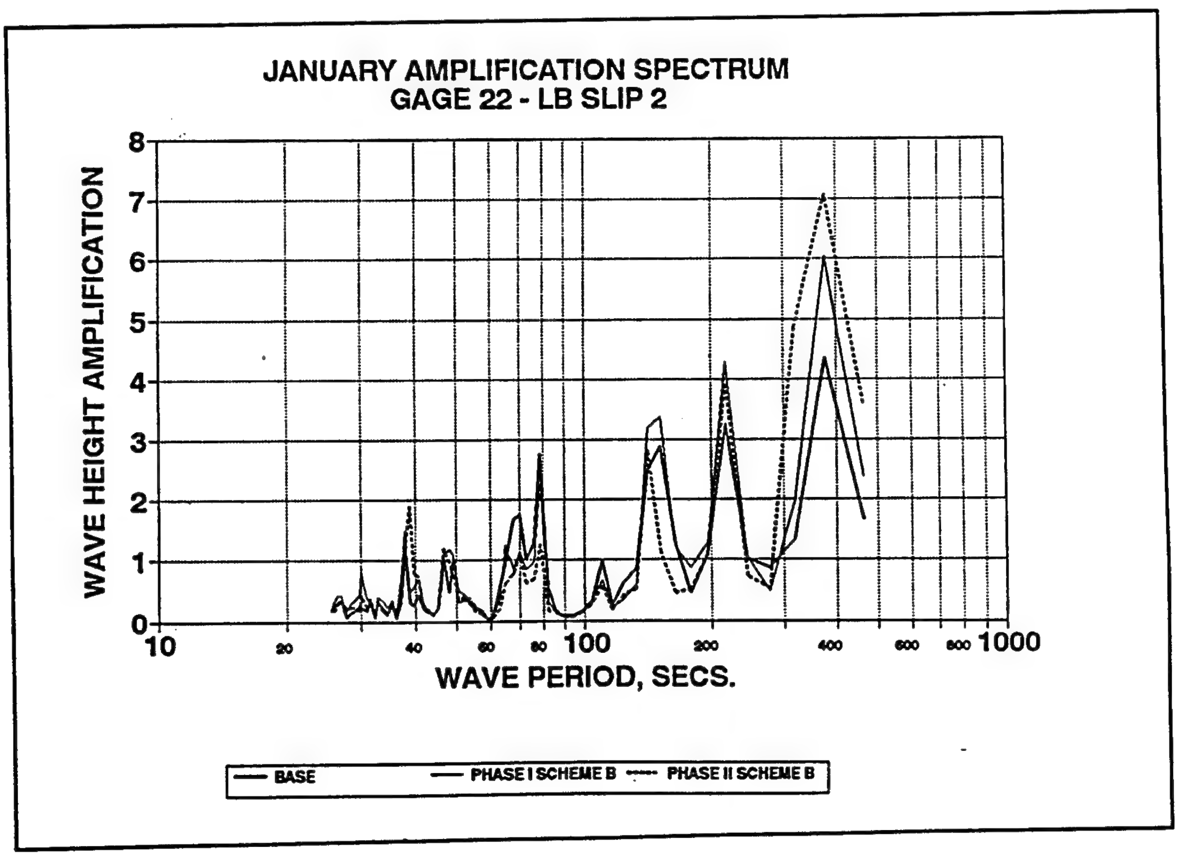



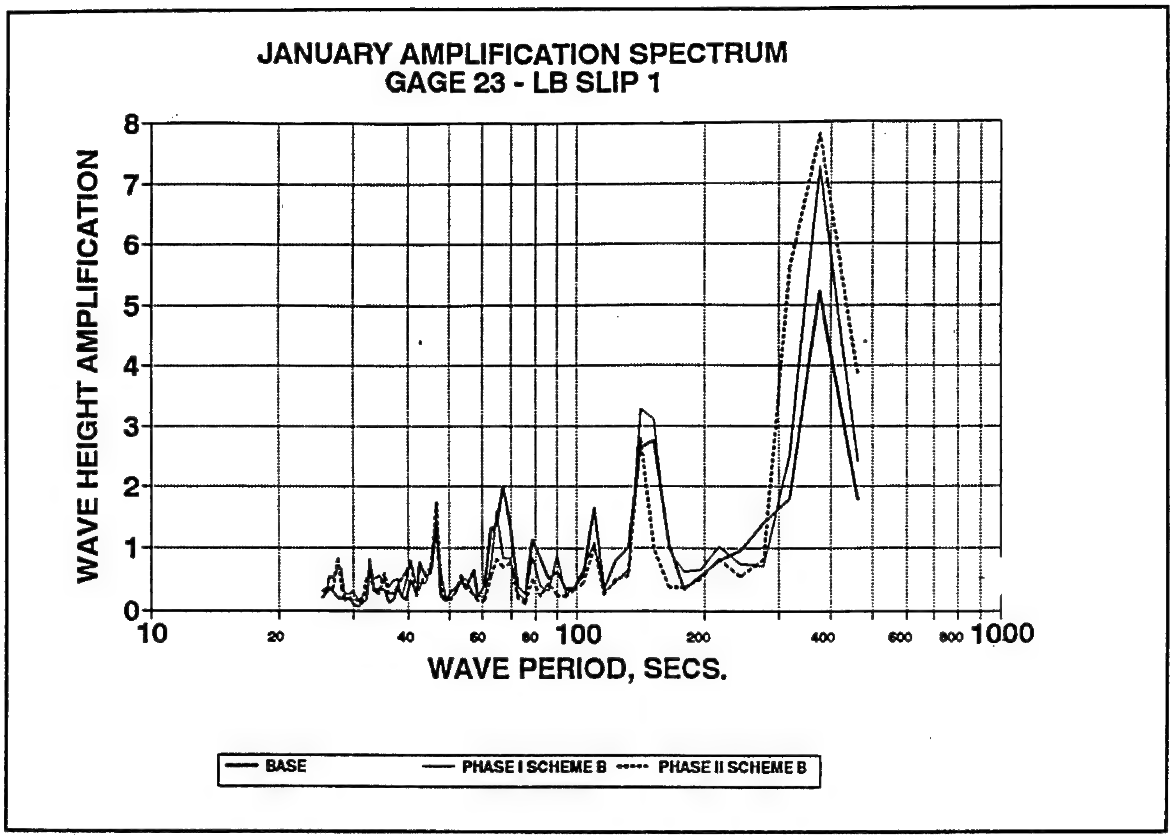
JANUARY AMPLIFICATION SPECTRUM
GAGE 18 - NAVY BASIN (MOLE)
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

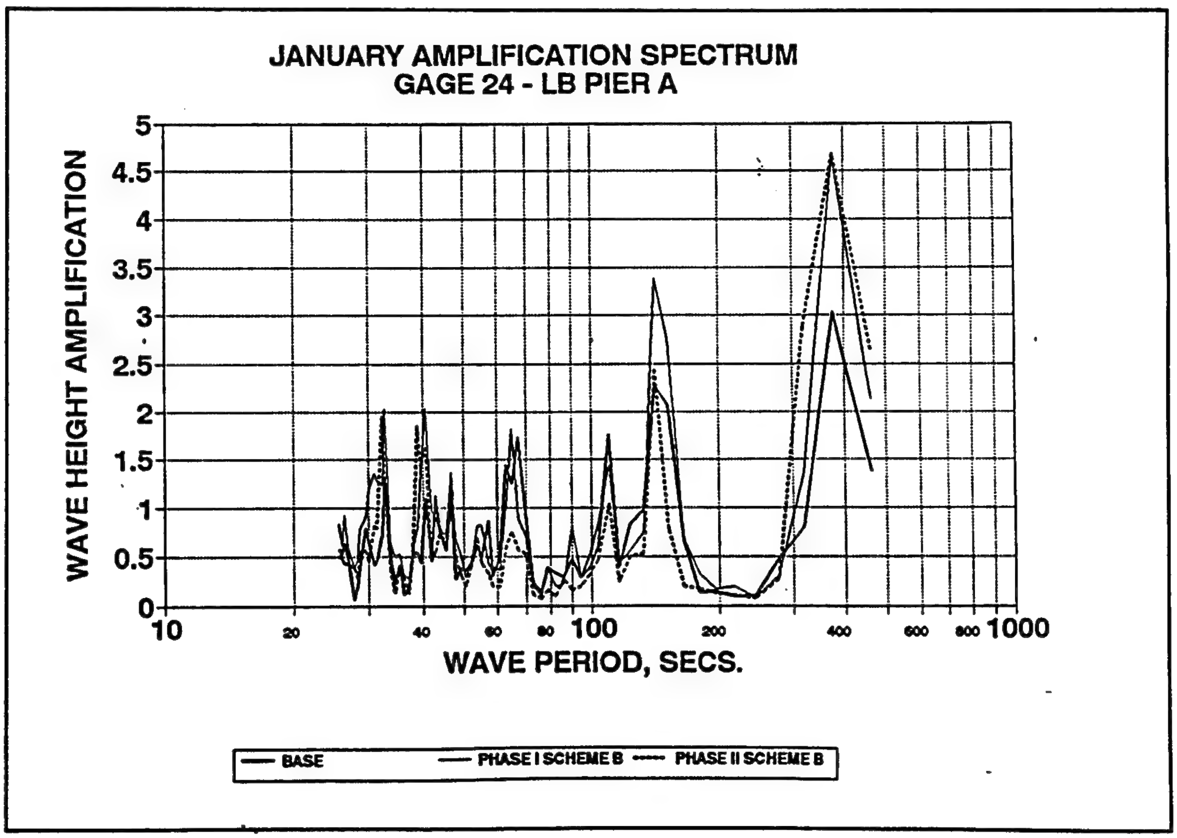

JANUARY AMPLIFICATION SPECTRUM
GAGE 19 - LB CHANNEL 2
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
7
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

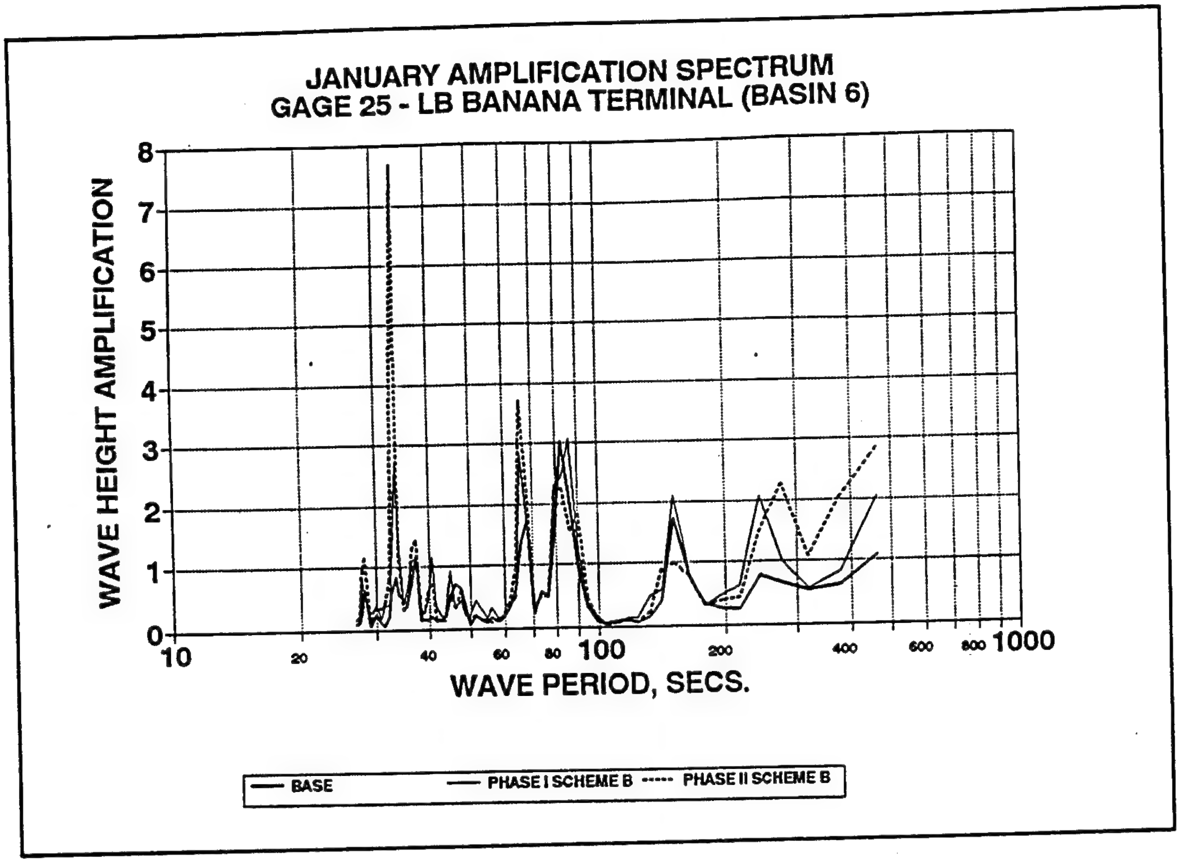

JANUARY AMPLIFICATION SPECTRUM
GAGE 20 - LB BACK CHANNEL
WAVE HEIGHT AMPLIFICATION
0
2
4
6
8
10
12
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

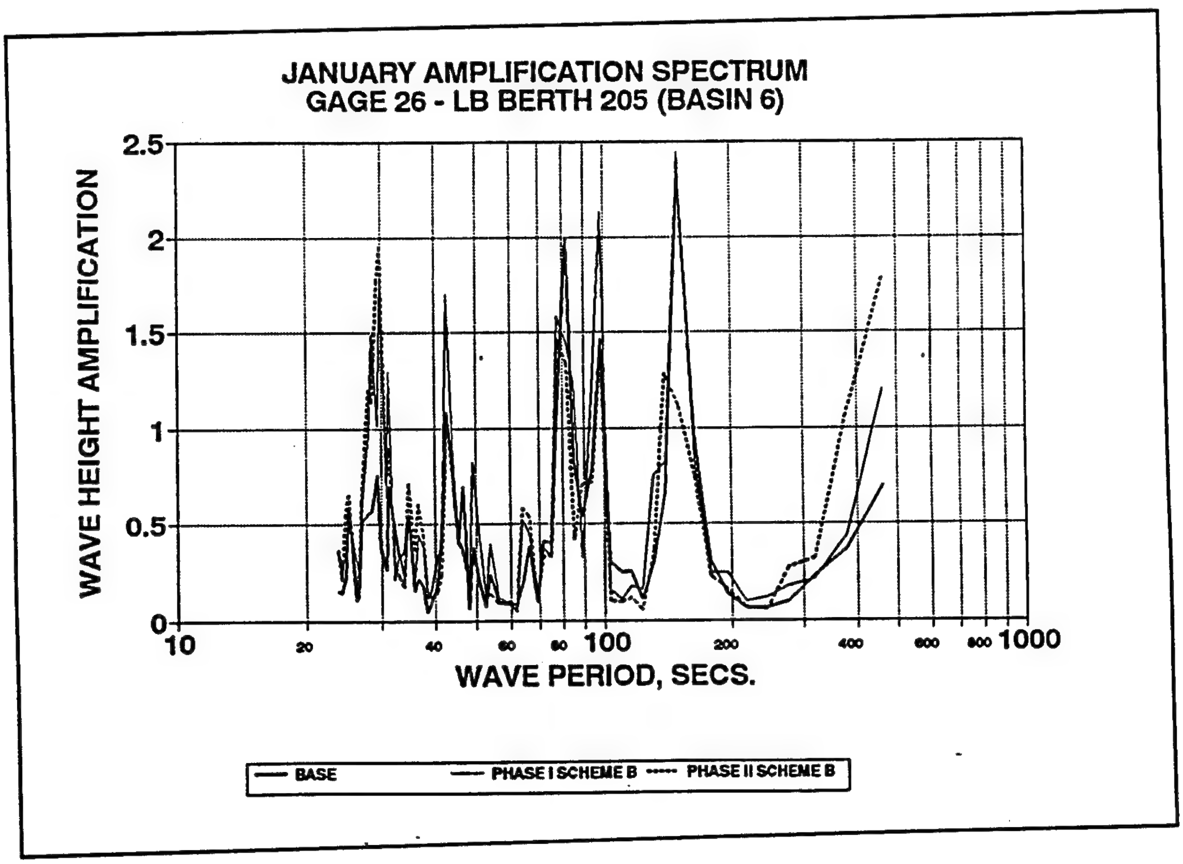

JANUARY AMPLIFICATION SPECTRUM
GAGE 21 - LB SLIP 3
WAVE HEIGHT AMPLIFICATION
0
2
4
6
8
10
12
14
16
18
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

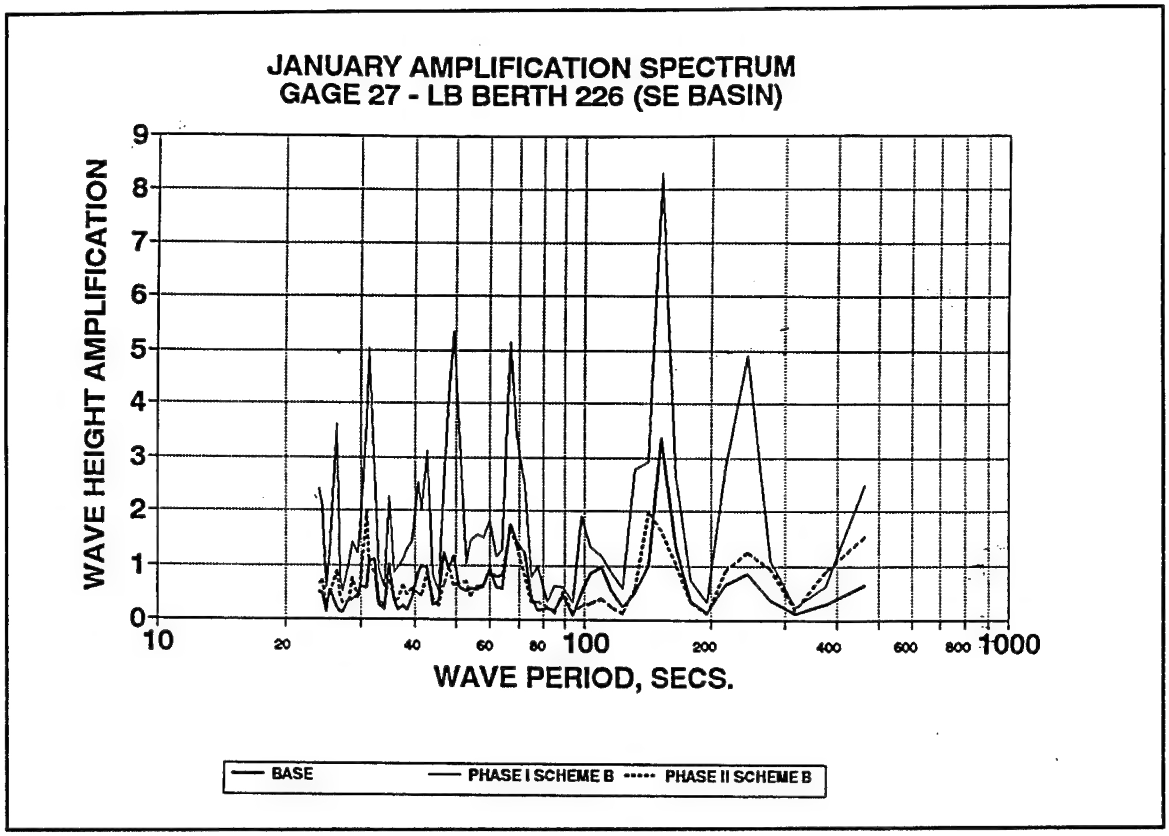

JANUARY AMPLIFICATION SPECTRUM
GAGE 22 - LB SLIP 2
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
7
8
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

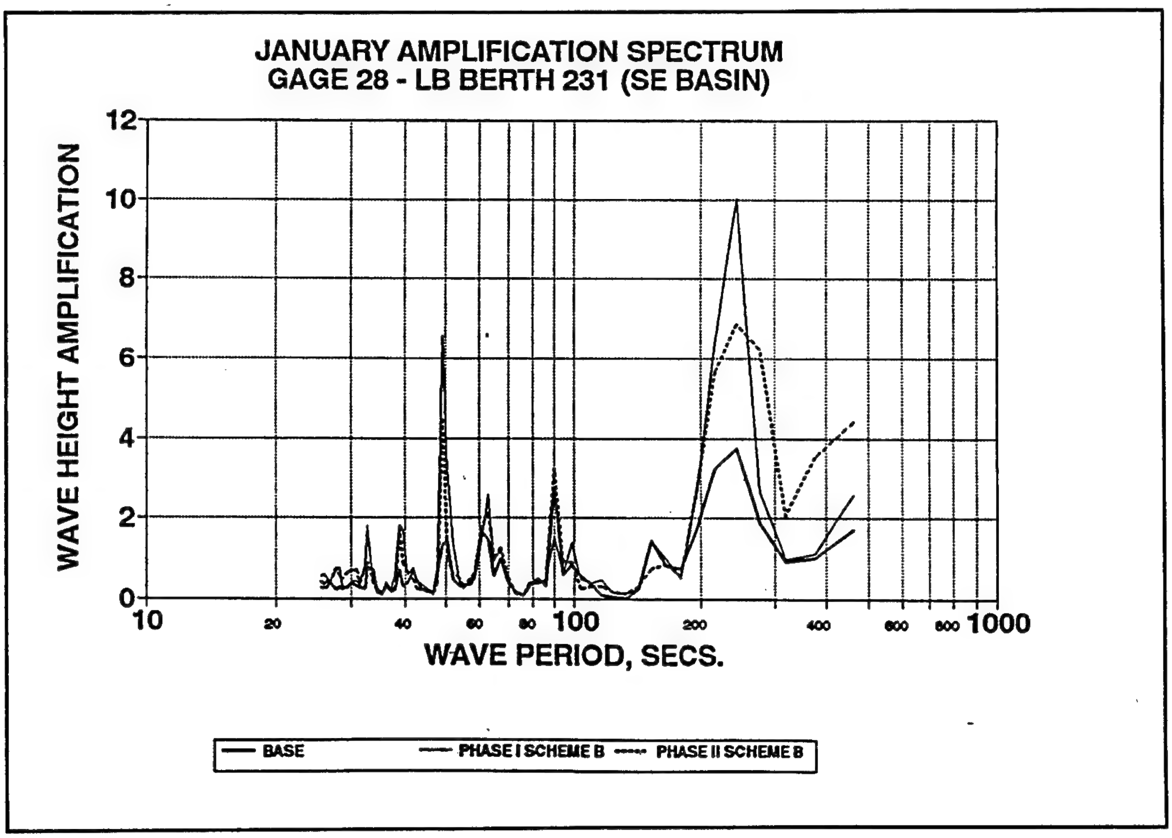

JANUARY AMPLIFICATION SPECTRUM
GAGE 23 - LB SLIP 1
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
7
8
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

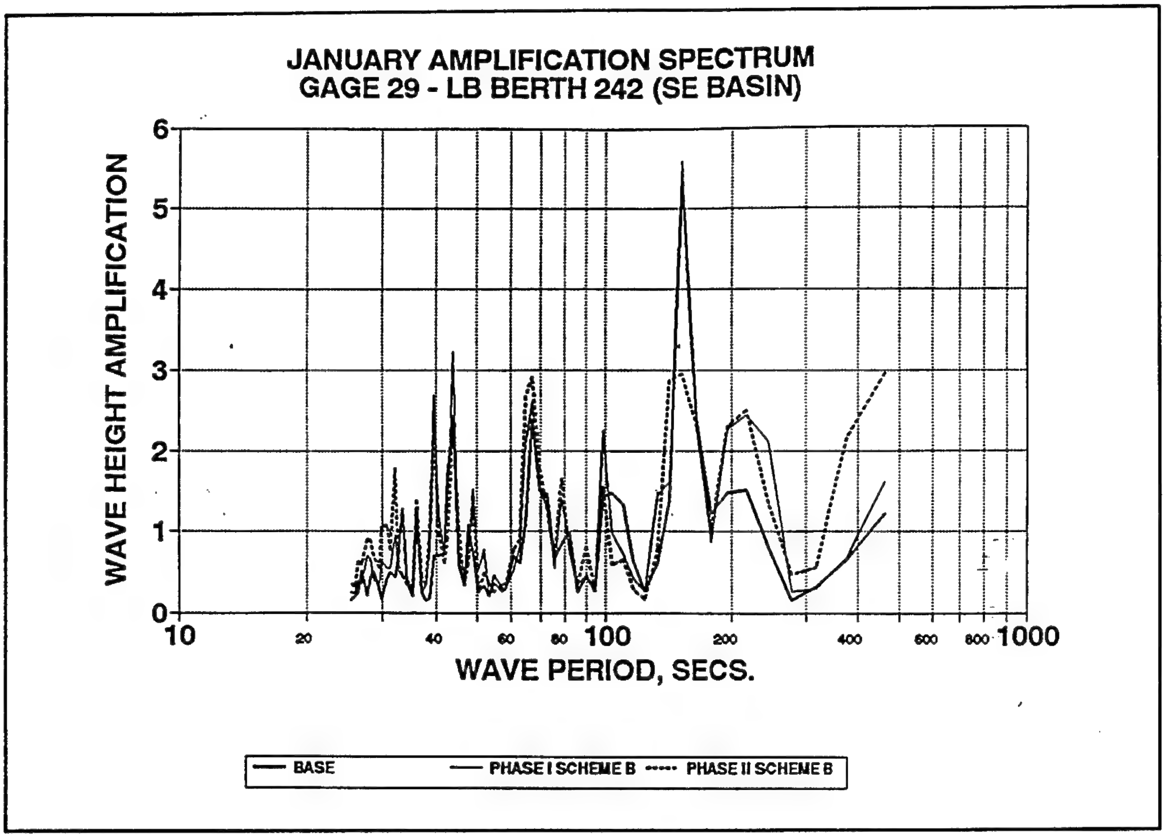

JANUARY AMPLIFICATION SPECTRUM
GAGE 24 - LB PIER A
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B


JANUARY AMPLIFICATION SPECTRUM
GAGE 25 - LB BANANA TERMINAL (BASIN 6)
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

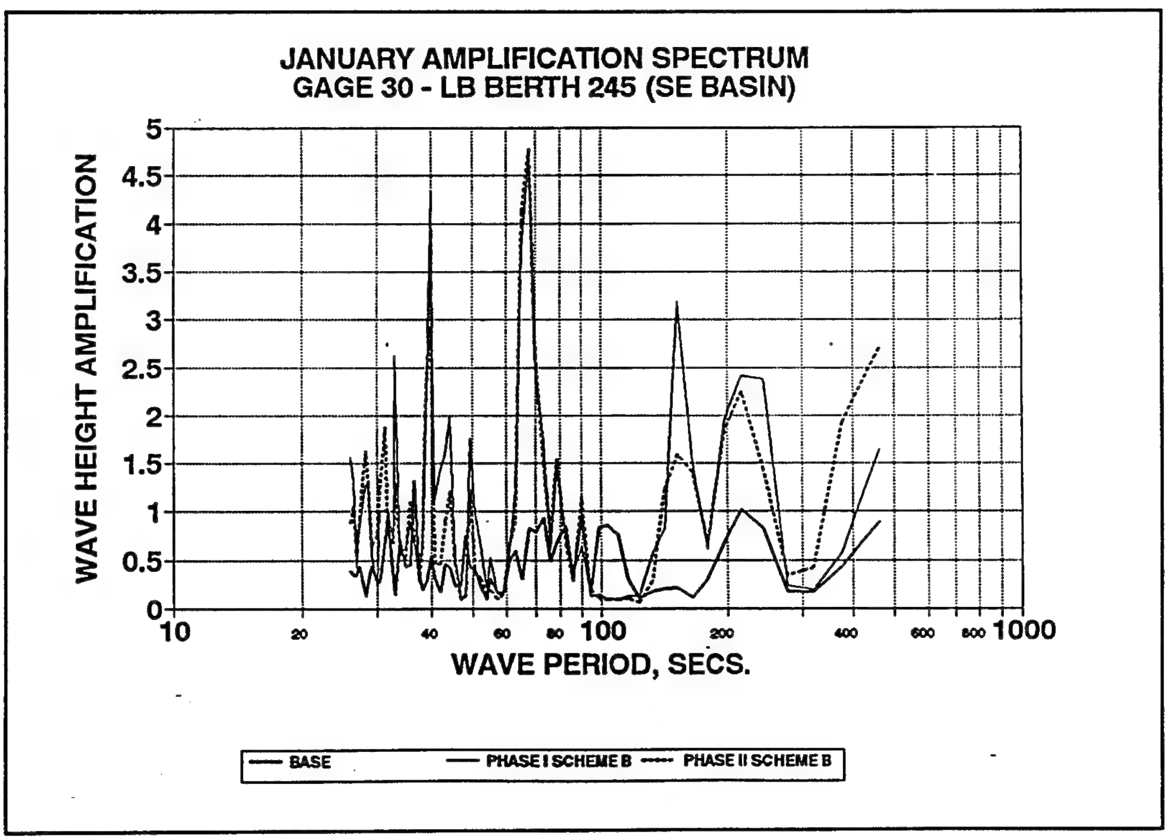

JANUARY AMPLIFICATION SPECTRUM
GAGE 26 - LB BERTH 205 (BASIN 6)
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B


JANUARY AMPLIFICATION SPECTRUM
GAGE 27 - LB BERTH 226 (SE BASIN)
WAVE HEIGHT AMPLIFICATION
9
8
7
6
5
4
3
2
1
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

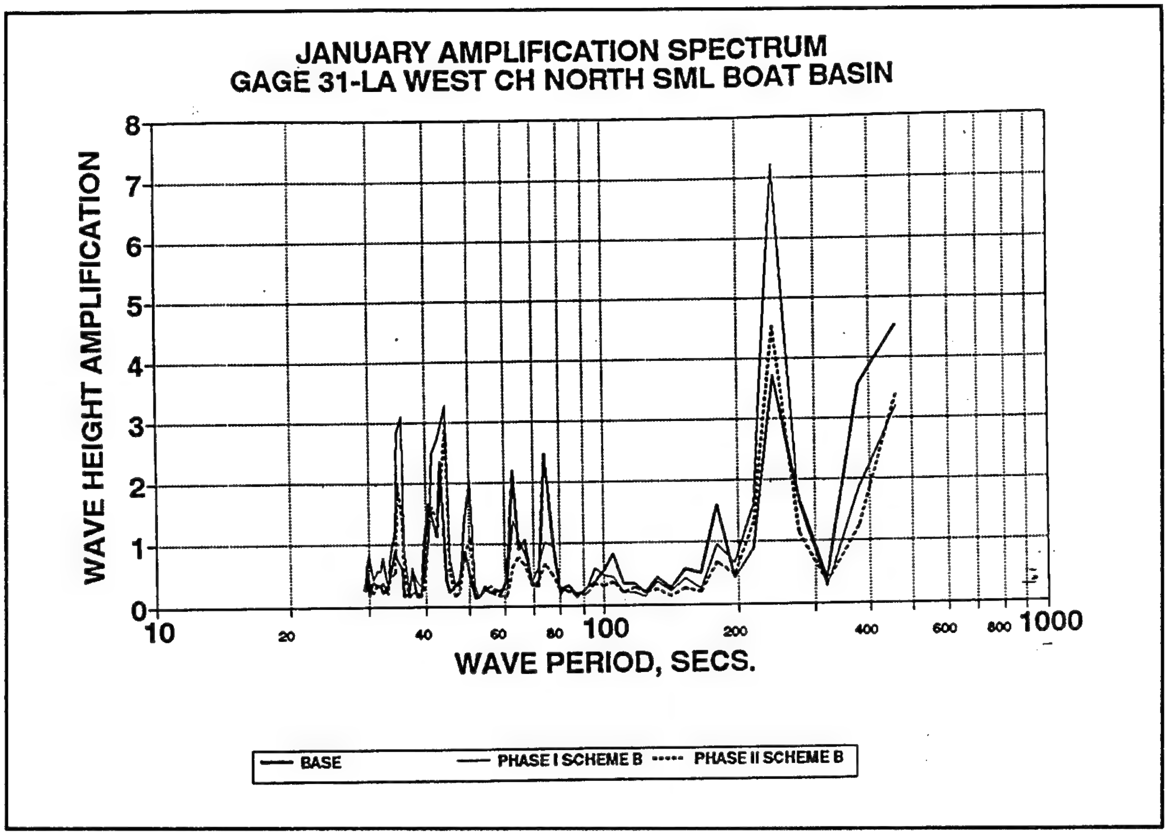

JANUARY AMPLIFICATION SPECTRUM
GAGE 28 - LB BERTH 231 (SE BASIN)
WAVE HEIGHT AMPLIFICATION
12
10
8
6
4
2
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

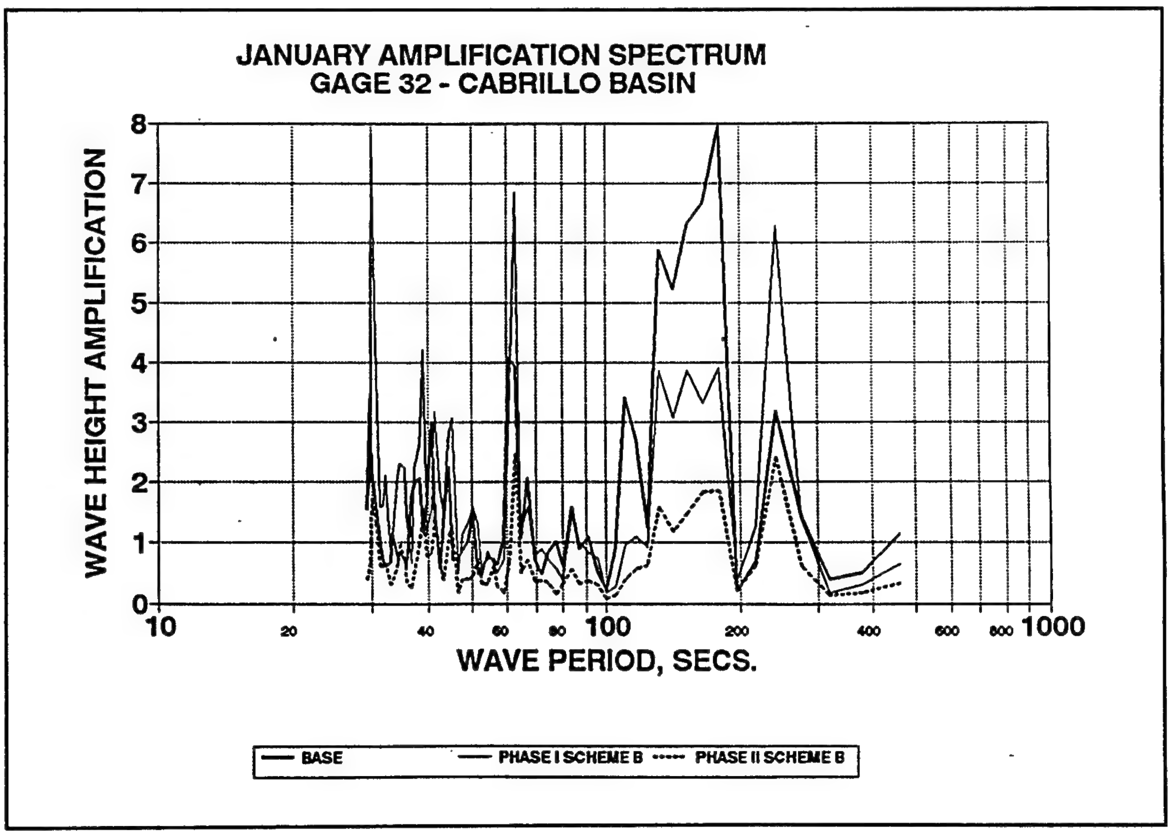


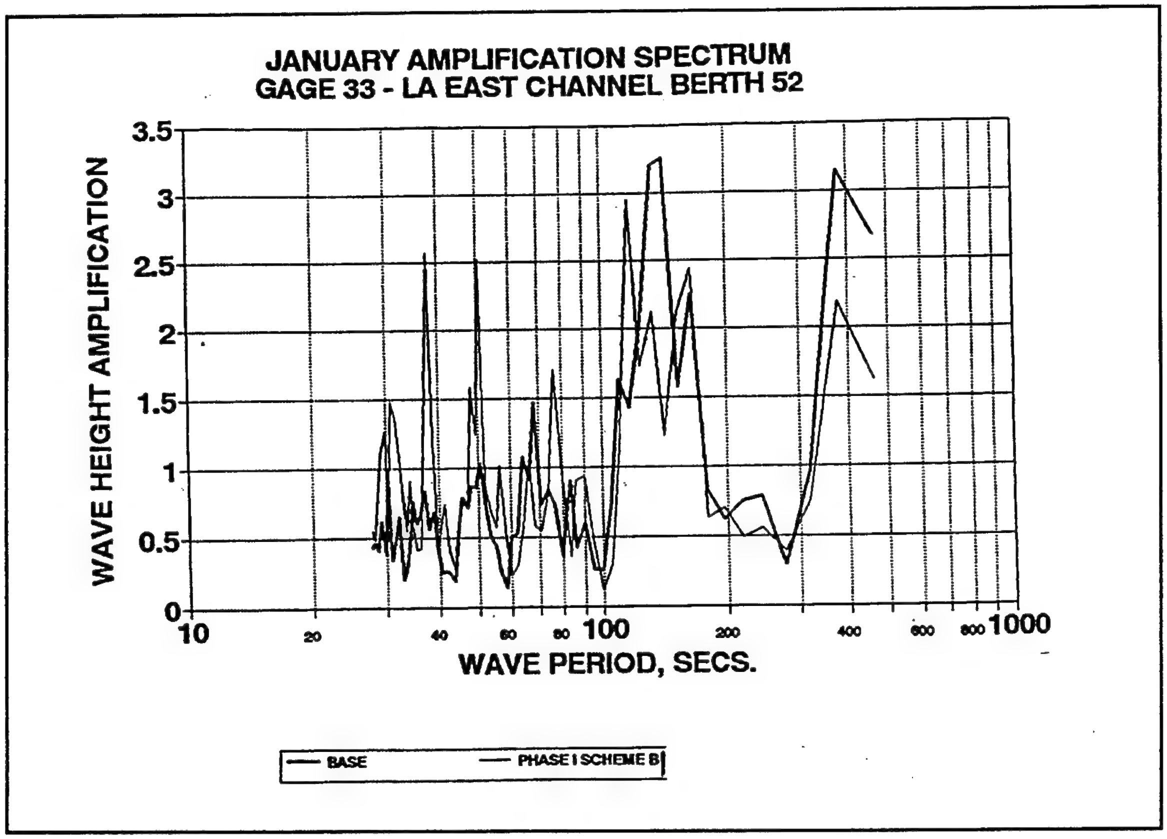
JANUARY AMPLIFICATION SPECTRUM
GAGE 29 - LB BERTH 242 (SE BASIN)
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

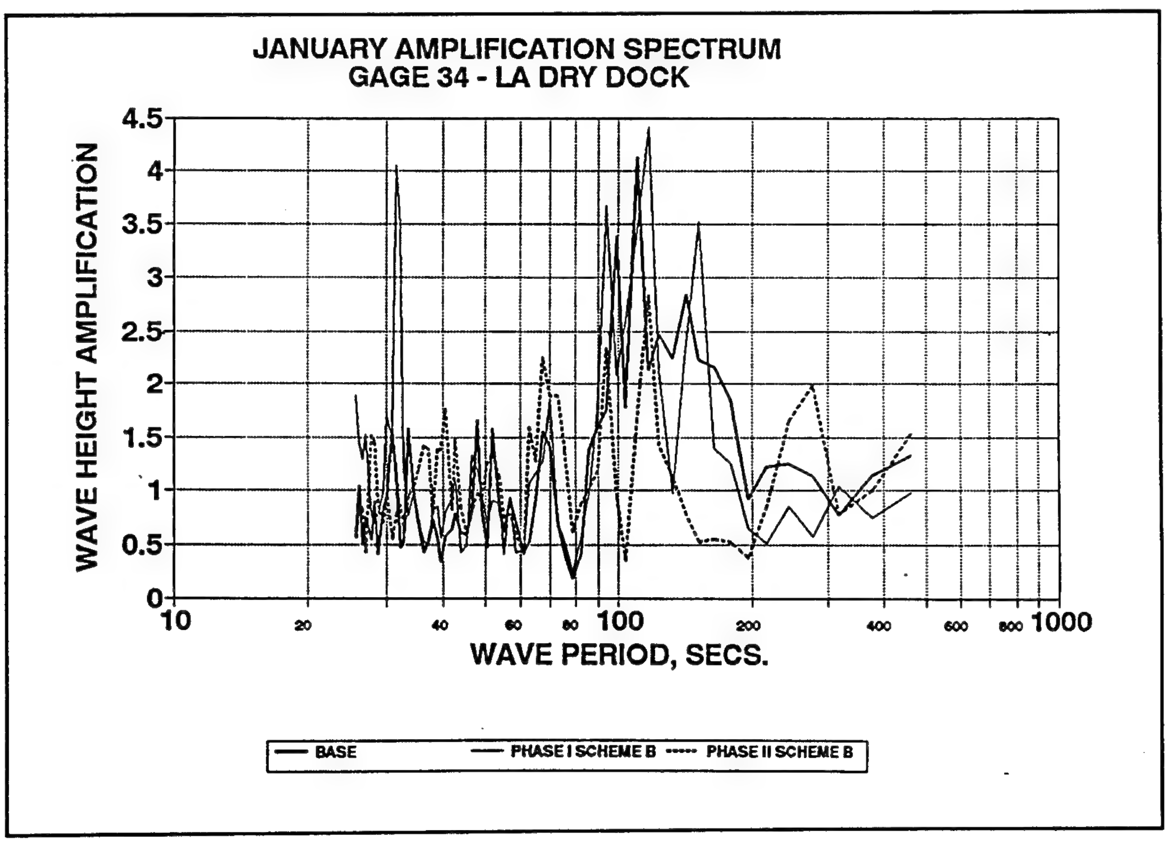



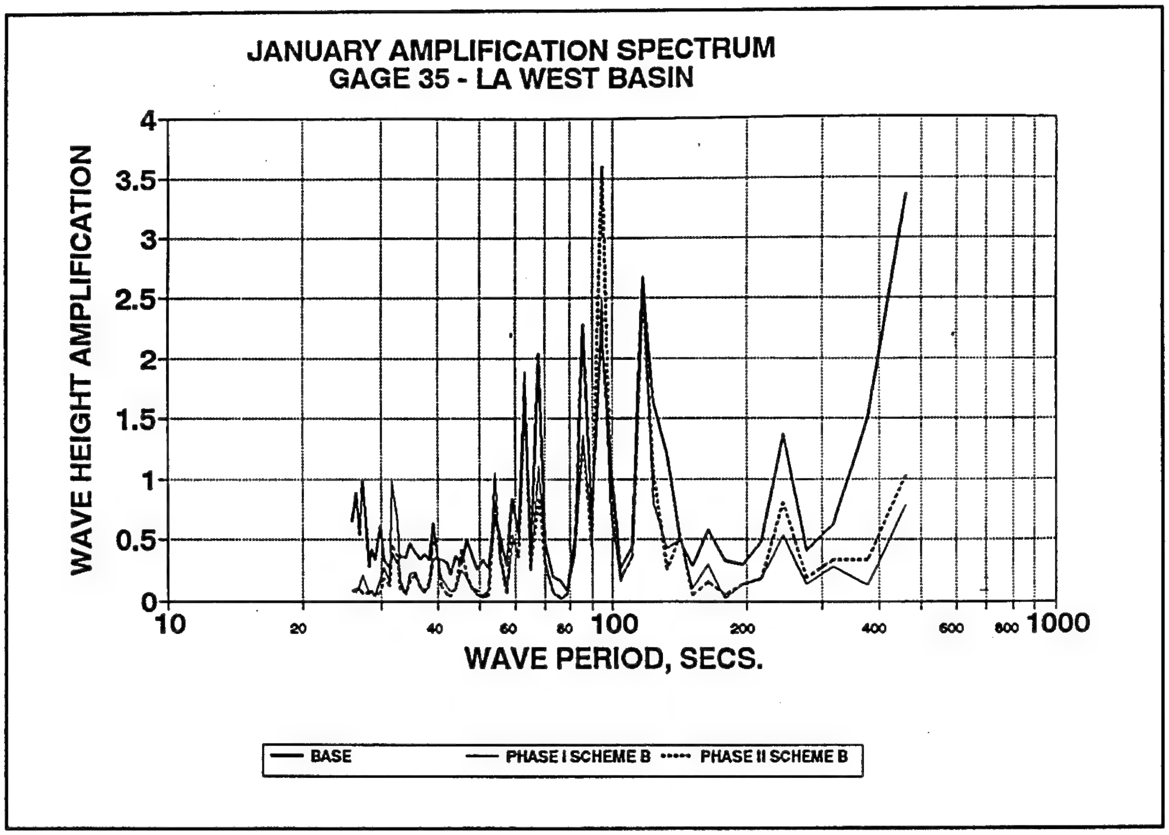
JANUARY AMPLIFICATION SPECTRUM
GAGE 30 - LB BERTH 245 (SE BASIN)
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

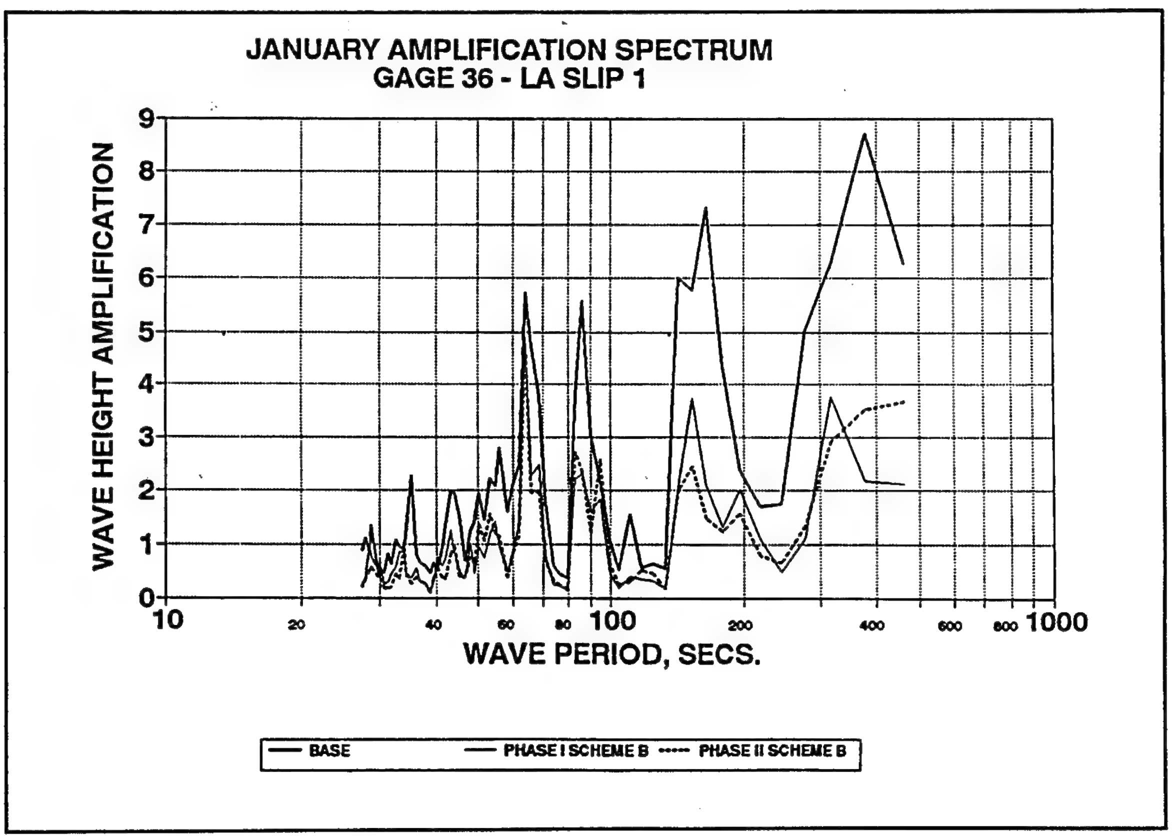

JANUARY AMPLIFICATION SPECTRUM
GAGE 31-LA WEST CH NORTH SML BOAT BASIN
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
7
8
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

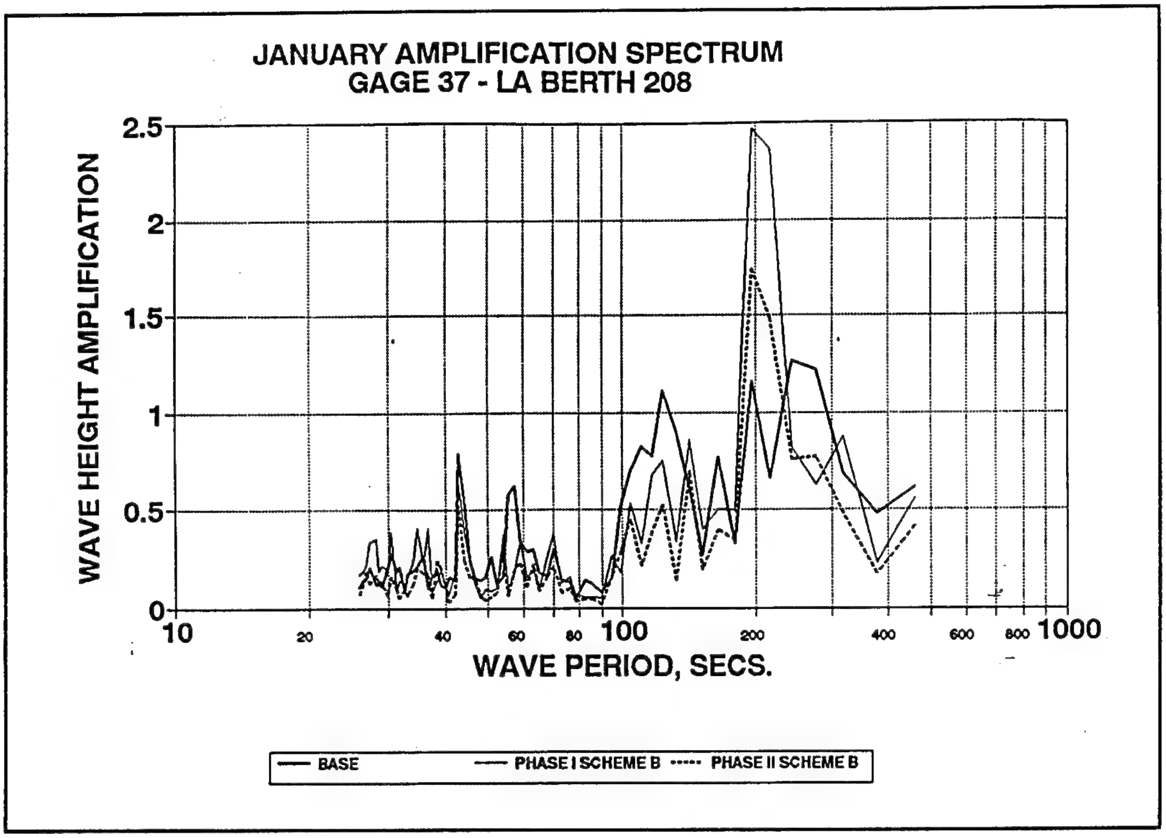

JANUARY AMPLIFICATION SPECTRUM
GAGE 32 - CABRILLO BASIN
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
7
8
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

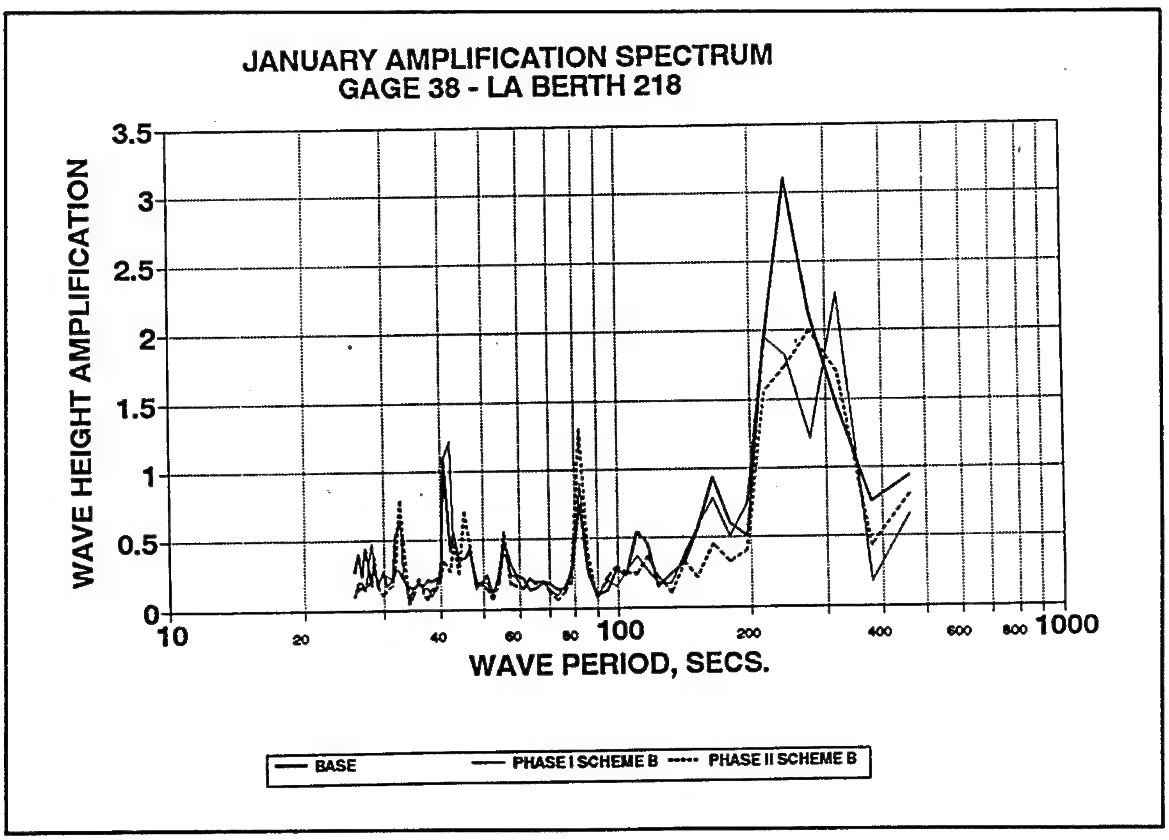

JANUARY AMPLIFICATION SPECTRUM
GAGE 33 - LA EAST CHANNEL BERTH 52
WAVE HEIGHT AMPLIFICATION
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B

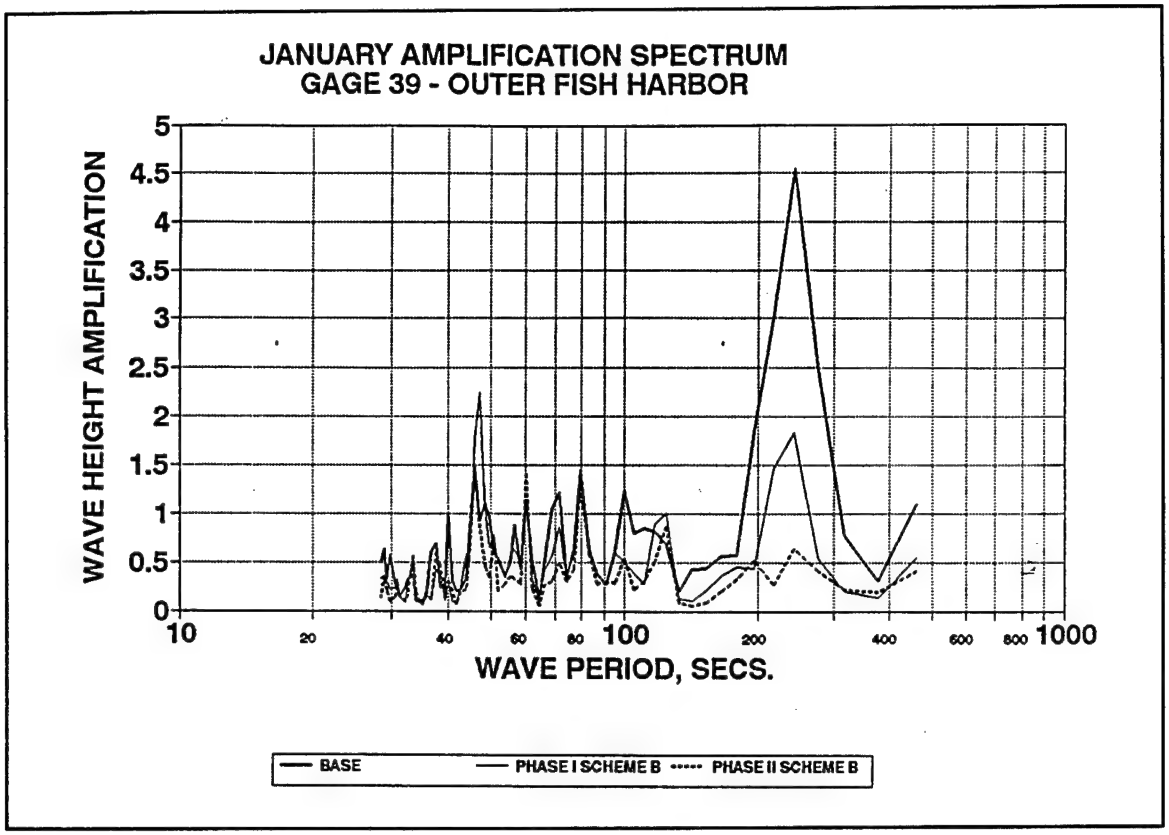

JANUARY AMPLIFICATION SPECTRUM
GAGE 34 - LA DRY DOCK
WAVE HEIGHT AMPLIFICATION
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

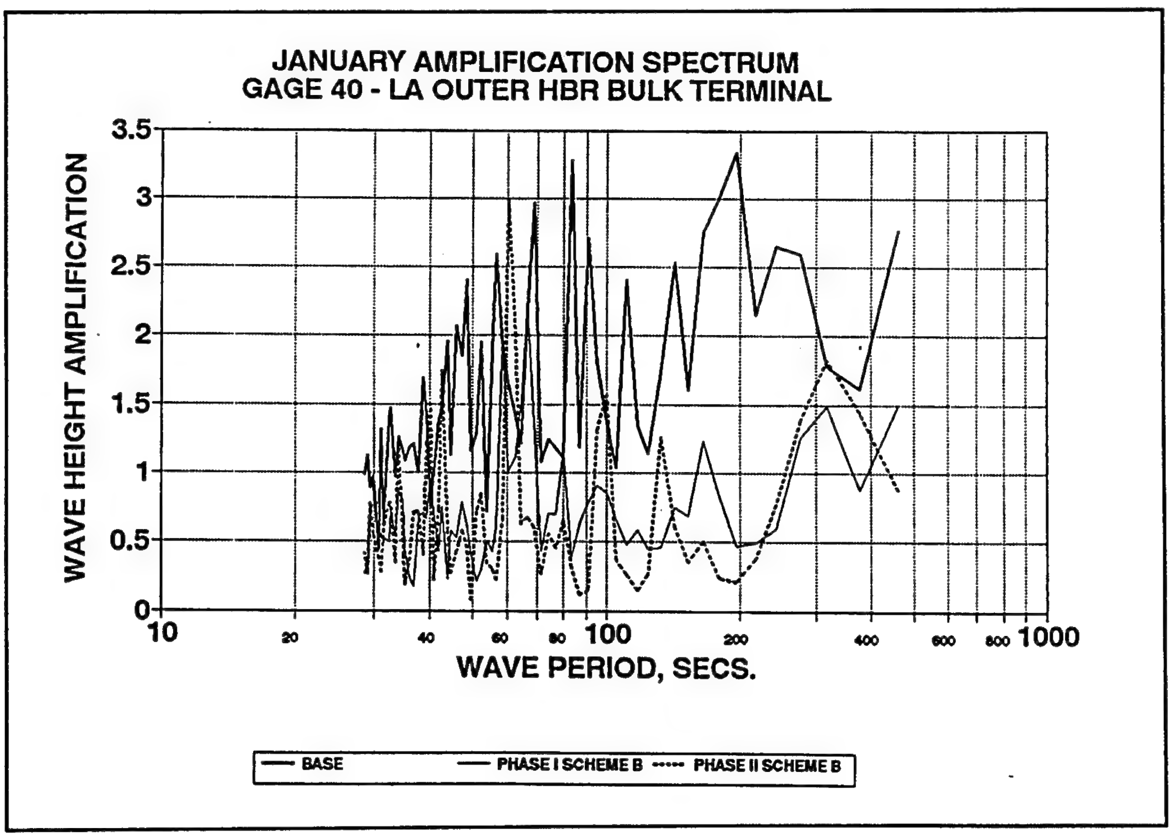

JANUARY AMPLIFICATION SPECTRUM
GAGE 35 - LA WEST BASIN
WAVE HEIGHT AMPLIFICATION
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

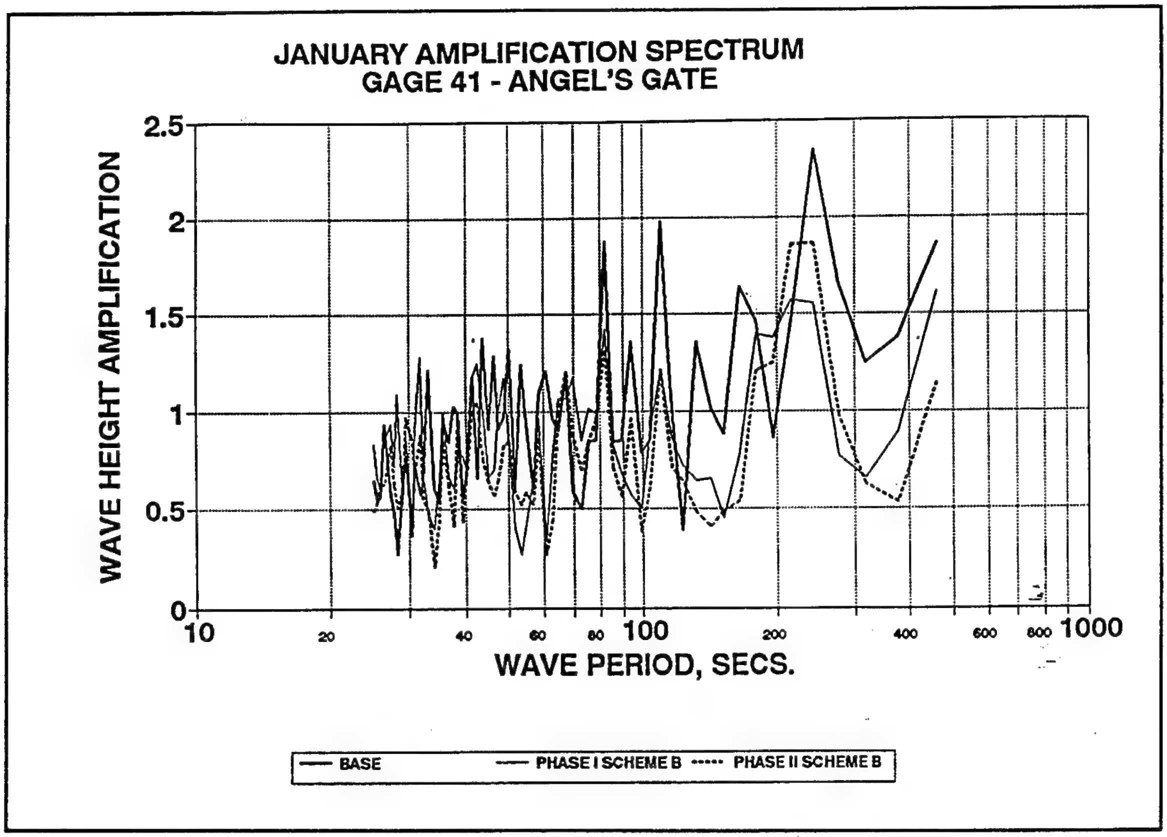

JANUARY AMPLIFICATION SPECTRUM
GAGE 36 - LA SLIP 1
WAVE HEIGHT AMPLIFICATION
9
8
7
6
5
4
3
2
1
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

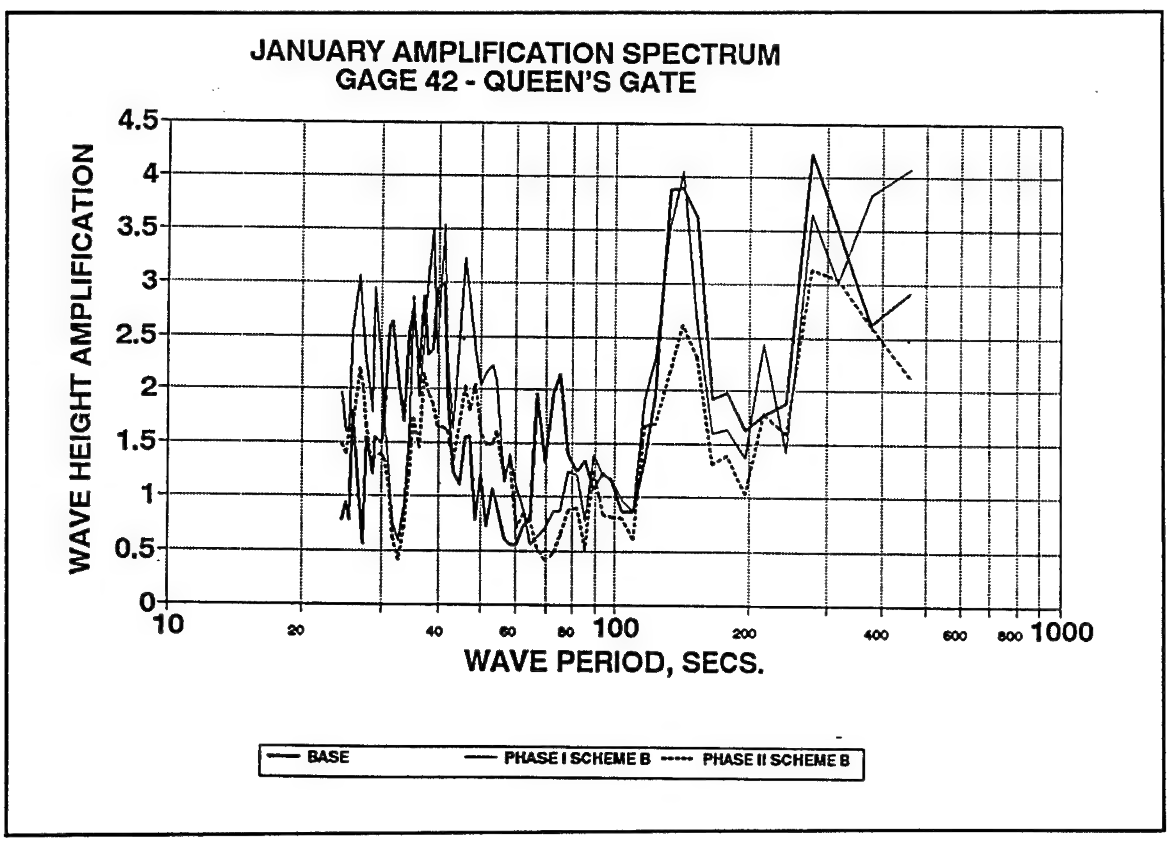

JANUARY AMPLIFICATION SPECTRUM
GAGE 37 - LA BERTH 208
WAVE HEIGHT AMPLIFICATION
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B


JANUARY AMPLIFICATION SPECTRUM
GAGE 38 - LA BERTH 218
WAVE HEIGHT AMPLIFICATION
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

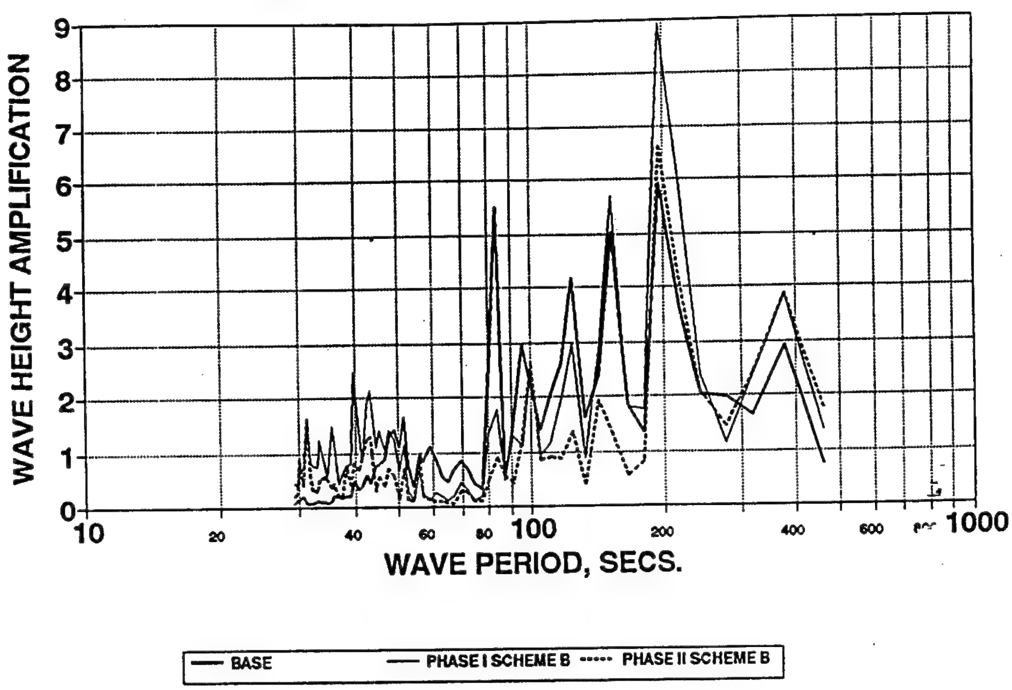

JANUARY AMPLIFICATION SPECTRUM
GAGE 39 - OUTER FISH HARBOR
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B


JANUARY AMPLIFICATION SPECTRUM
GAGE 40 - LA OUTER HBR BULK TERMINAL
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

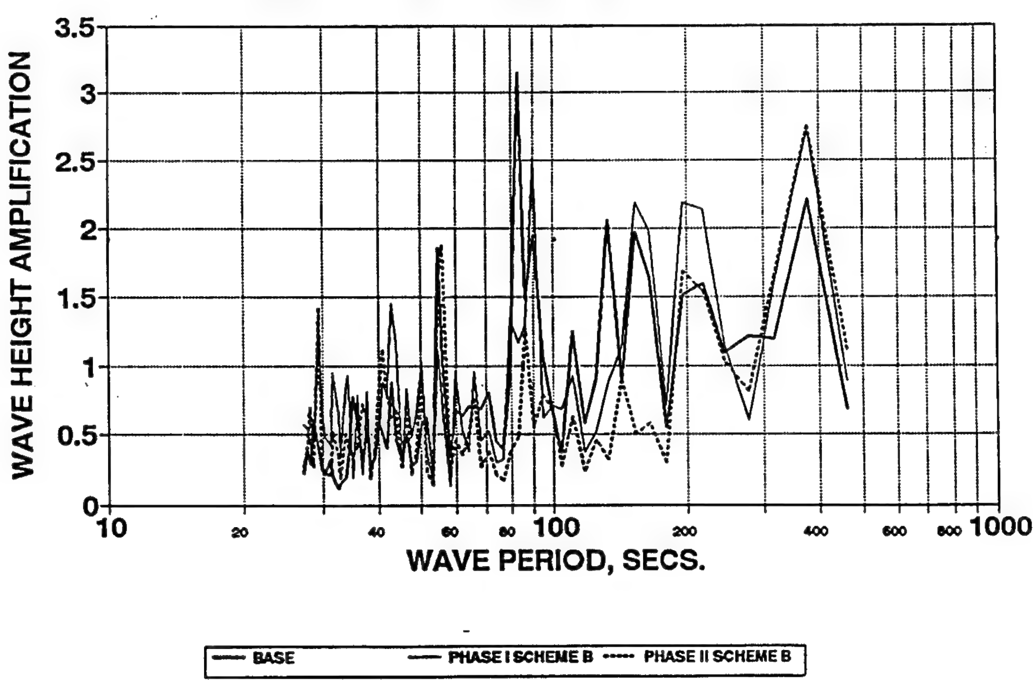

JANUARY AMPLIFICATION SPECTRUM
GAGE 41 - ANGEL'S GATE
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

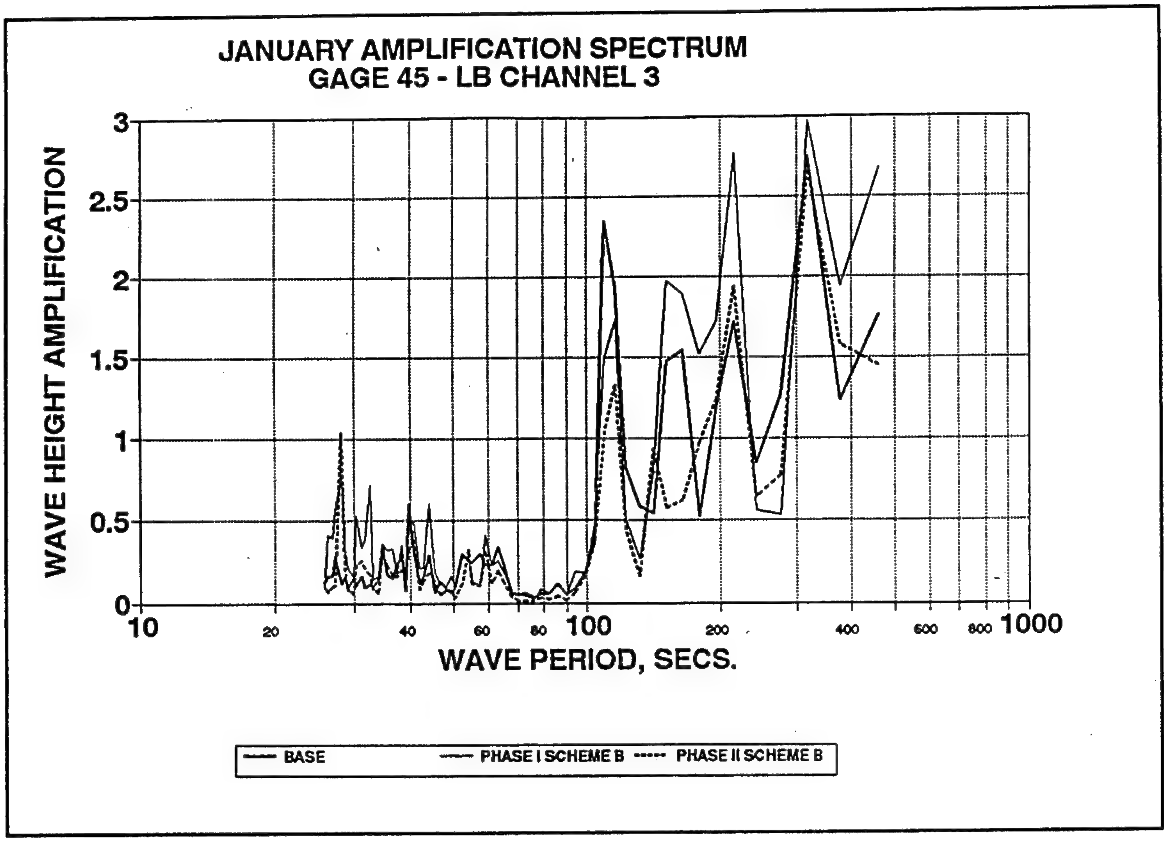

JANUARY AMPLIFICATION SPECTRUM
GAGE 42 - QUEEN'S GATE
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

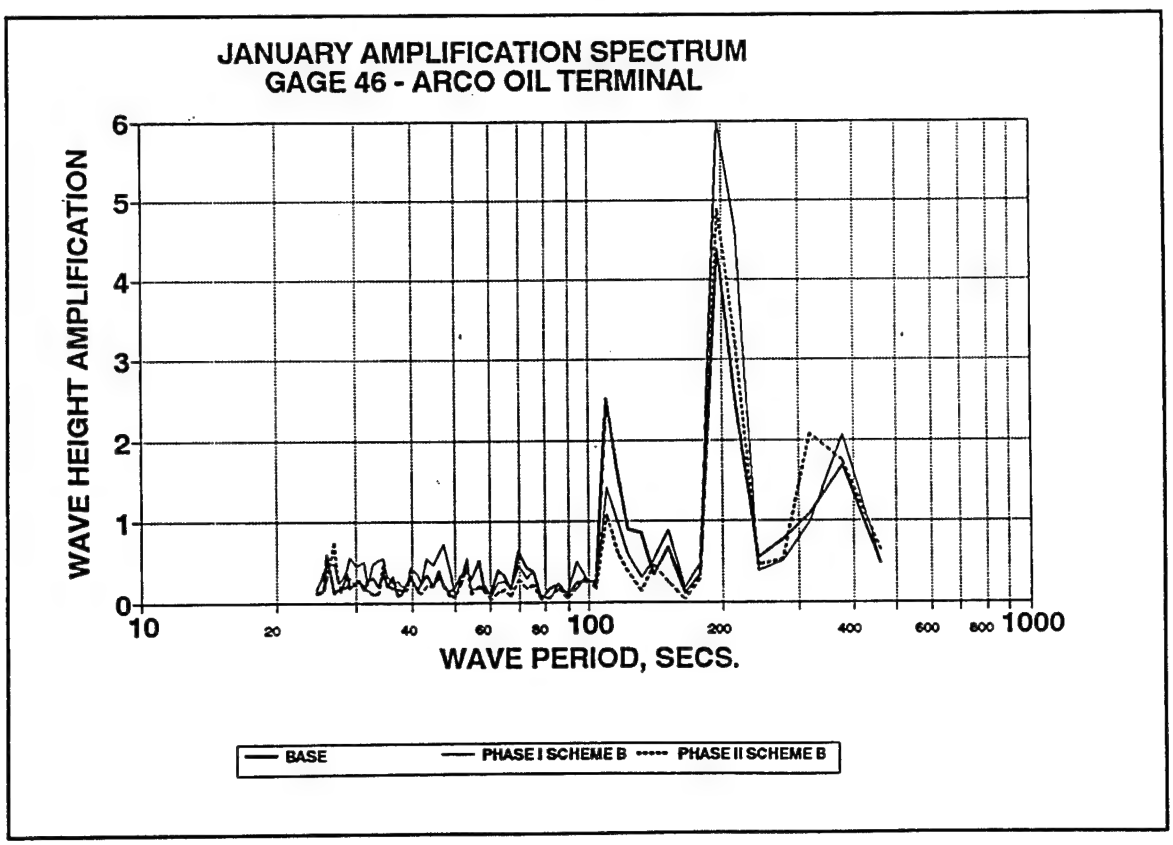
JANUARY AMPLIFICATION SPECTRUM
GAGE 43 - NW NAVY BASIN

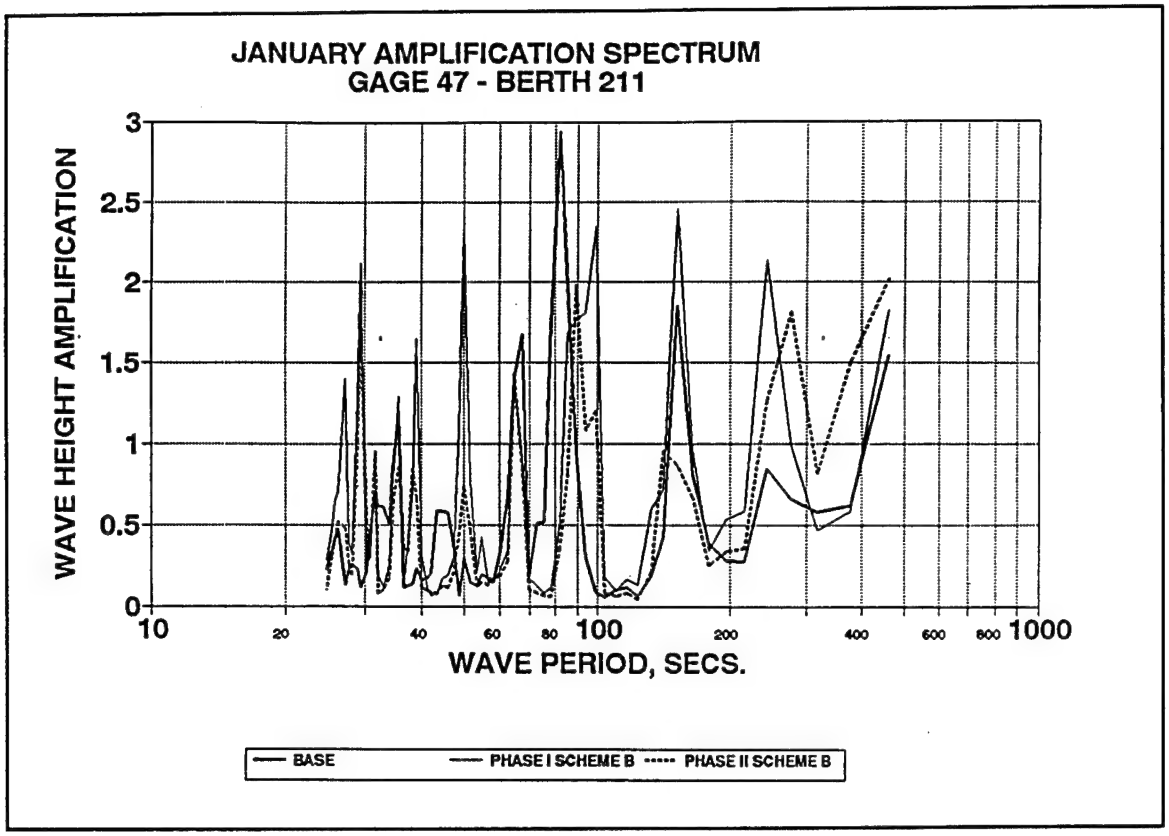


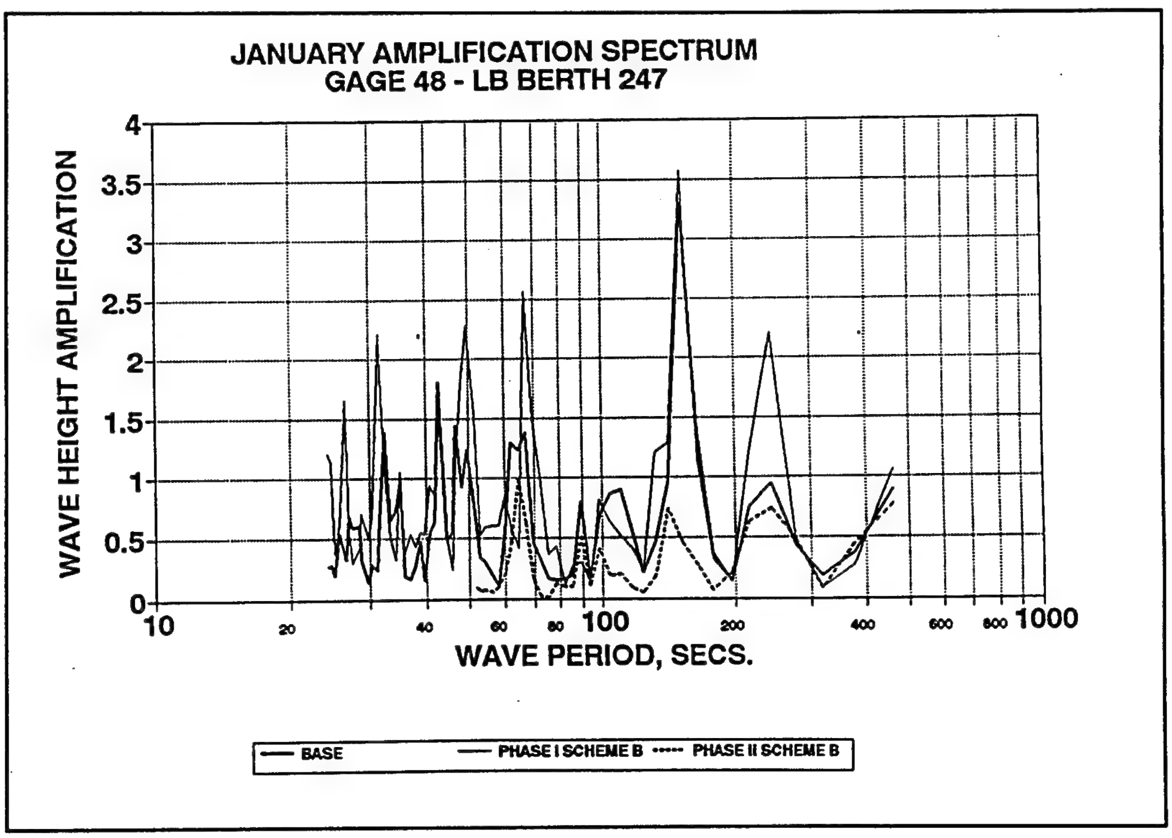

JANUARY AMPLIFICATION SPECTRUM
GAGE 44 - NAVY BASIN MOLE

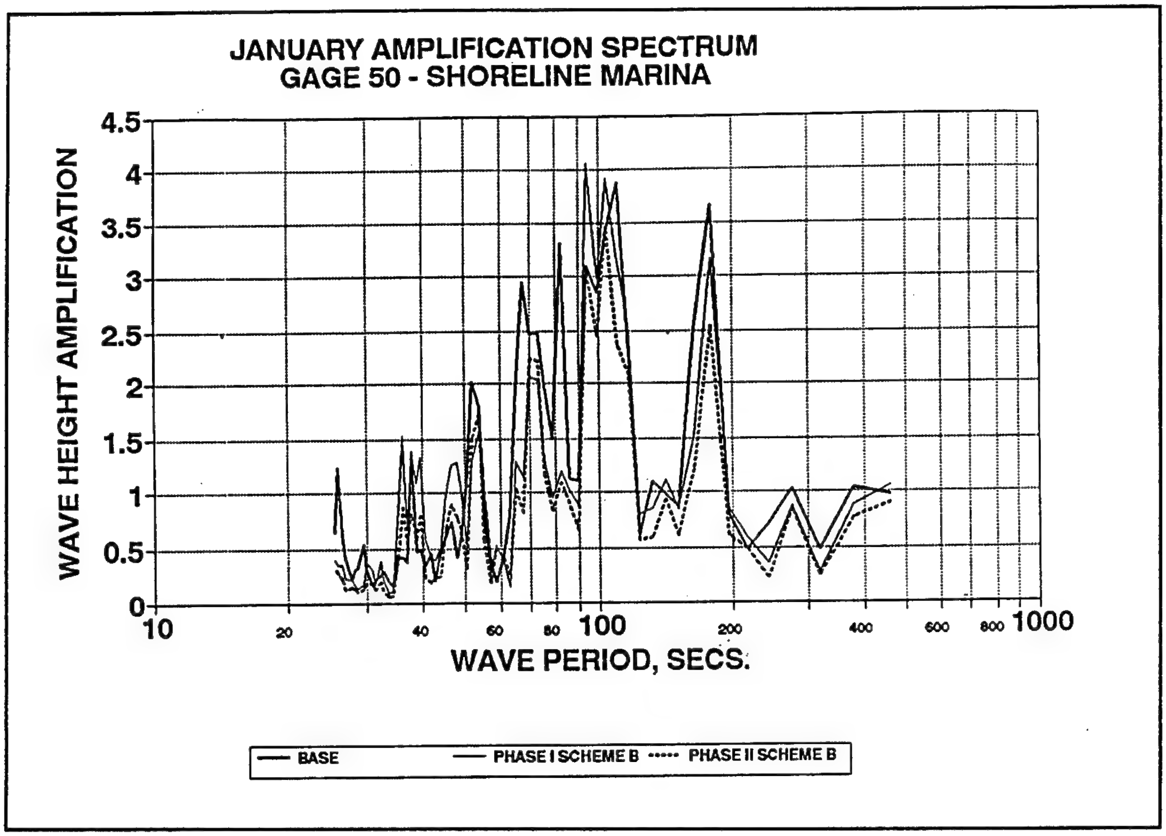


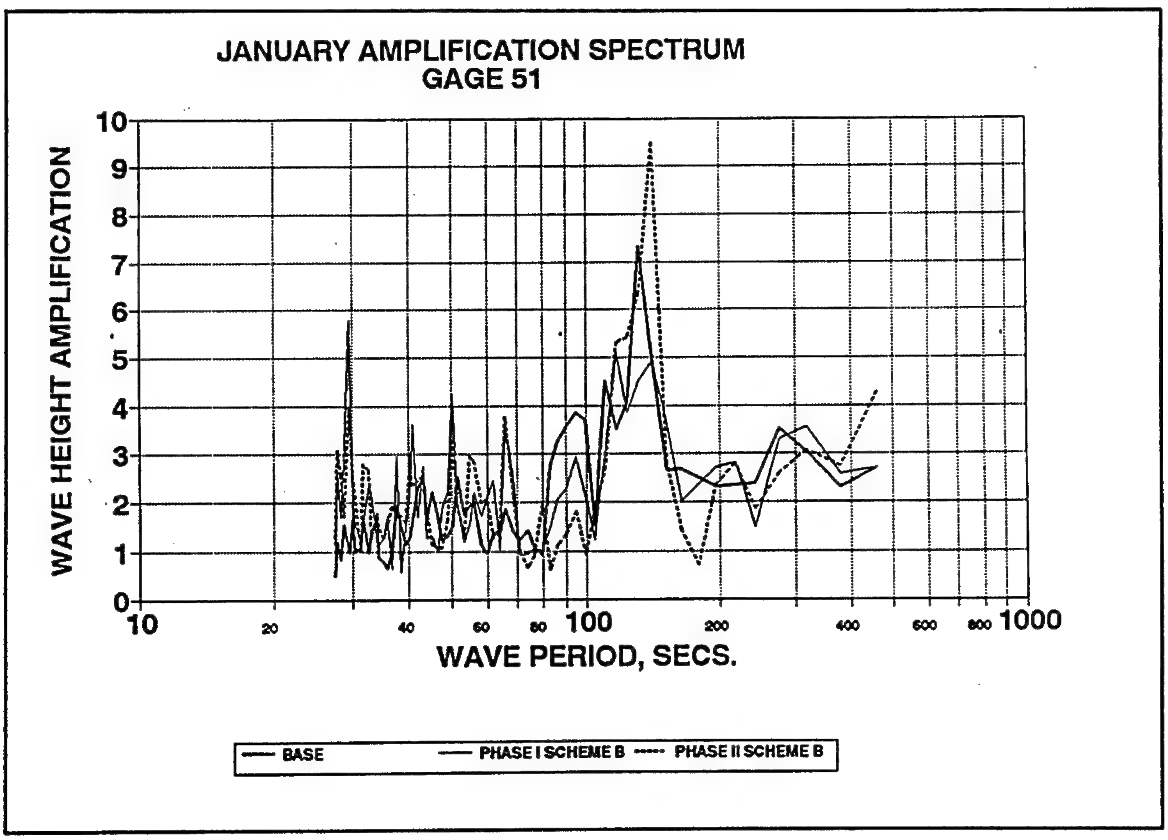

JANUARY AMPLIFICATION SPECTRUM
GAGE 45 - LB CHANNEL 3
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

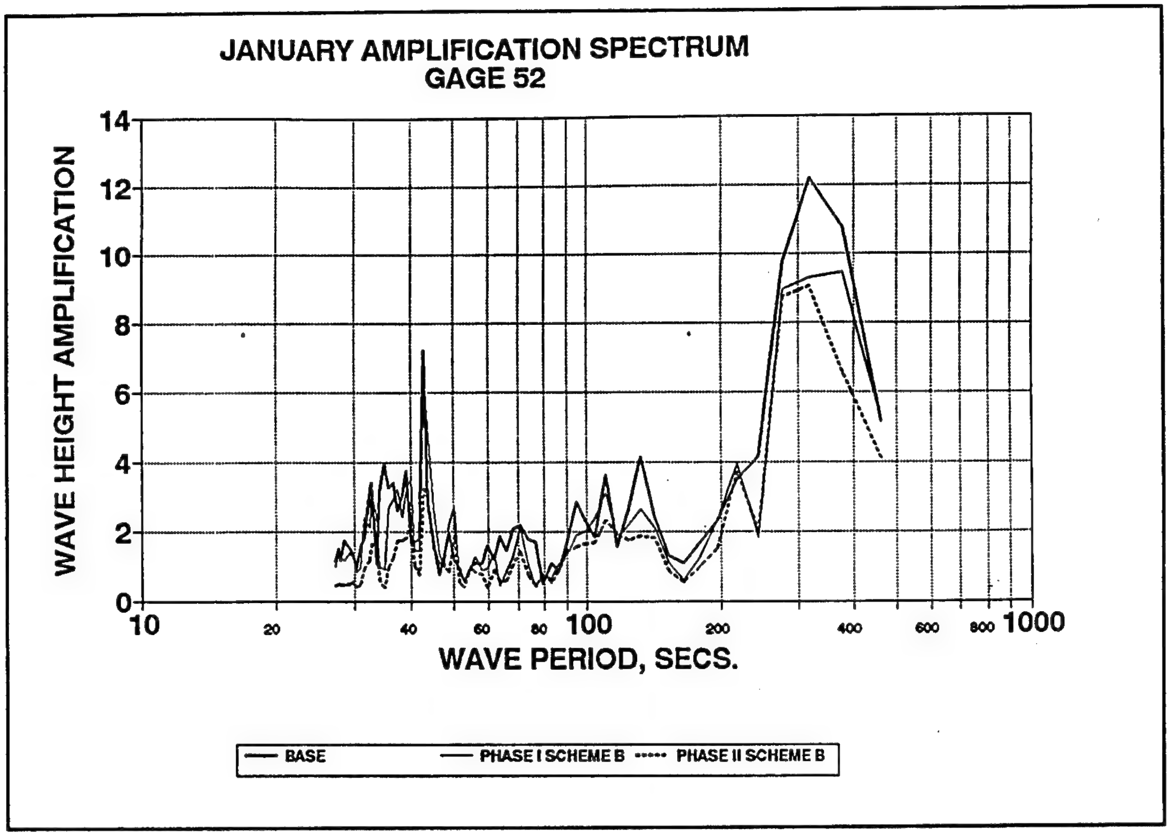

JANUARY AMPLIFICATION SPECTRUM
GAGE 46 - ARCO OIL TERMINAL
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

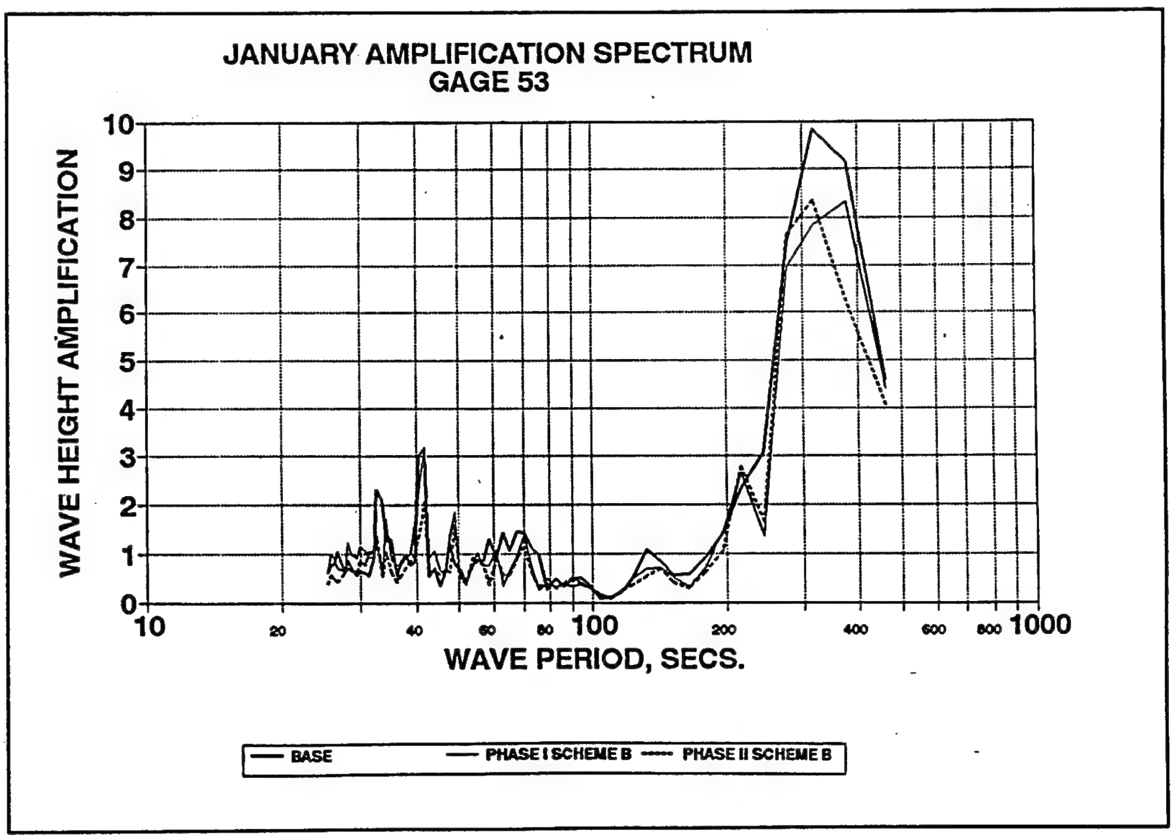

JANUARY AMPLIFICATION SPECTRUM
GAGE 47 - BERTH 211
WAVE HEIGHT AMPLIFICATION
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

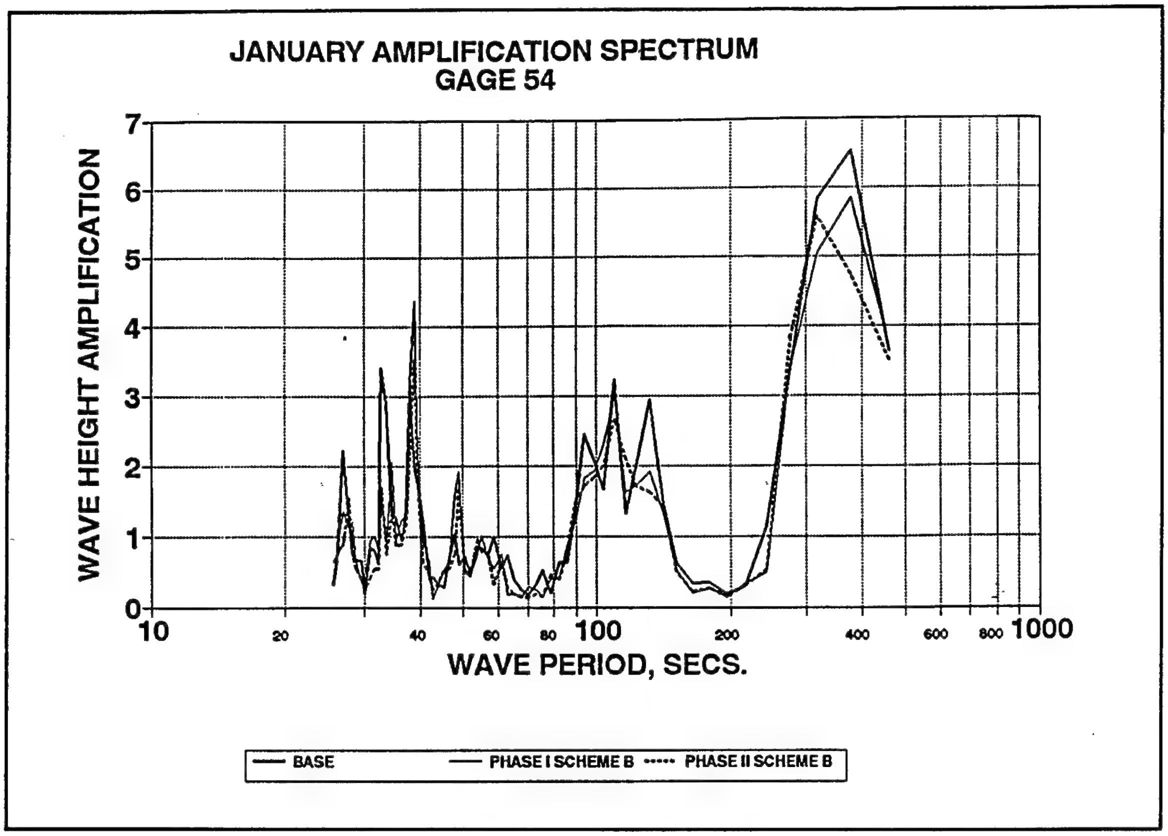

JANUARY AMPLIFICATION SPECTRUM
GAGE 48 - LB BERTH 247
WAVE HEIGHT AMPLIFICATION
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

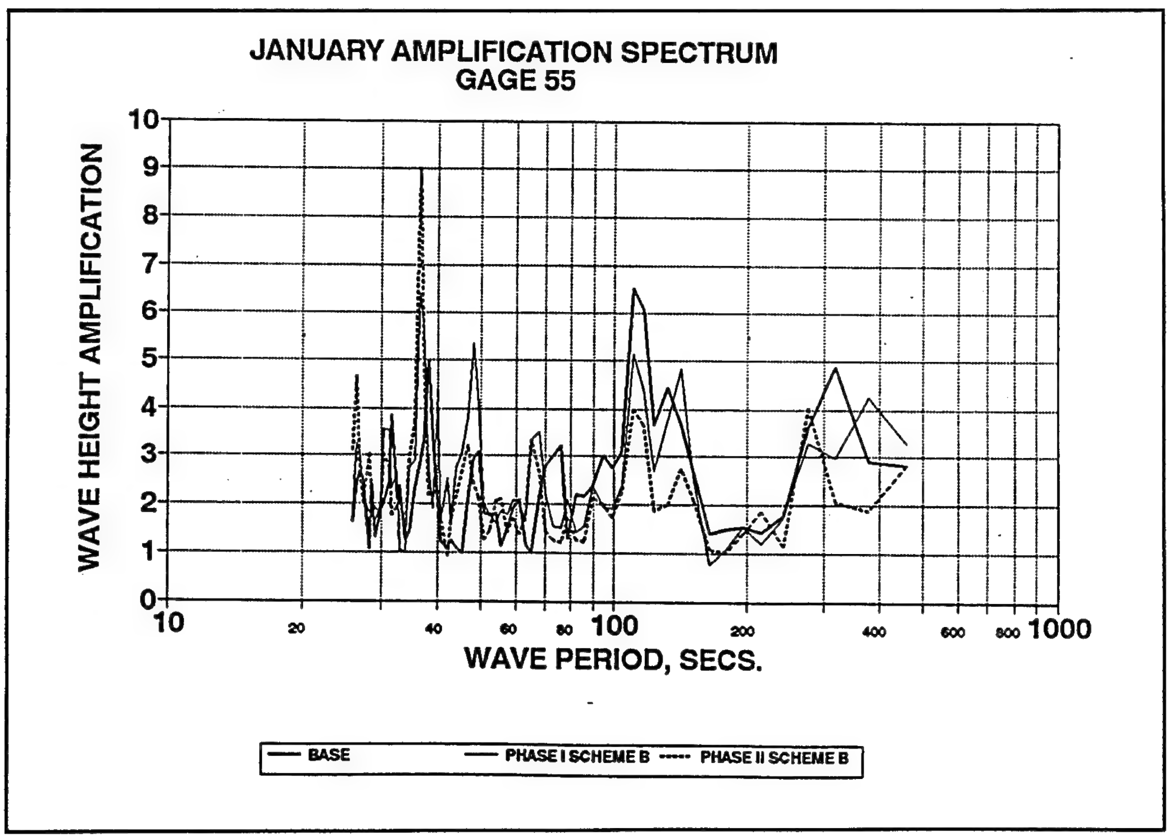

JANUARY AMPLIFICATION SPECTRUM
GAGE 50 - SHORELINE MARINA
WAVE HEIGHT AMPLIFICATION
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

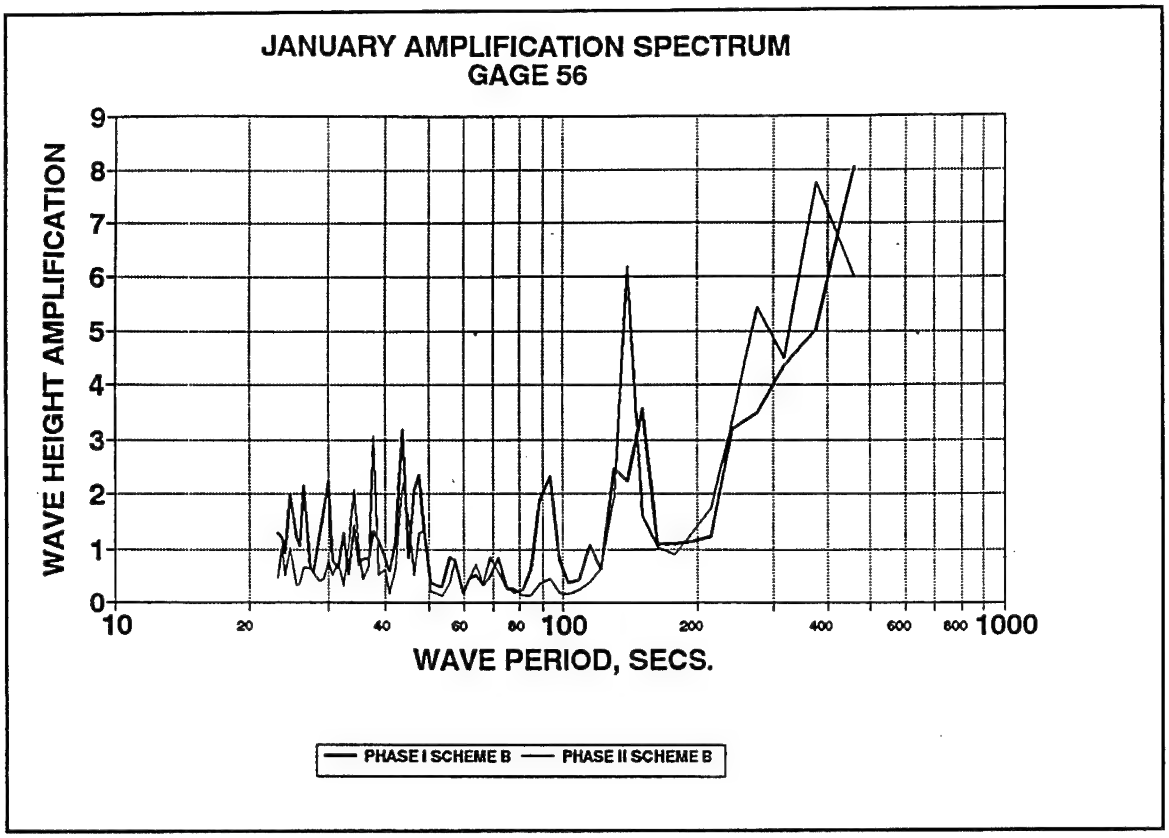

JANUARY AMPLIFICATION SPECTRUM
GAGE 51
WAVE HEIGHT AMPLIFICATION
10
9
8
7
6
5
4
3
2
1
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

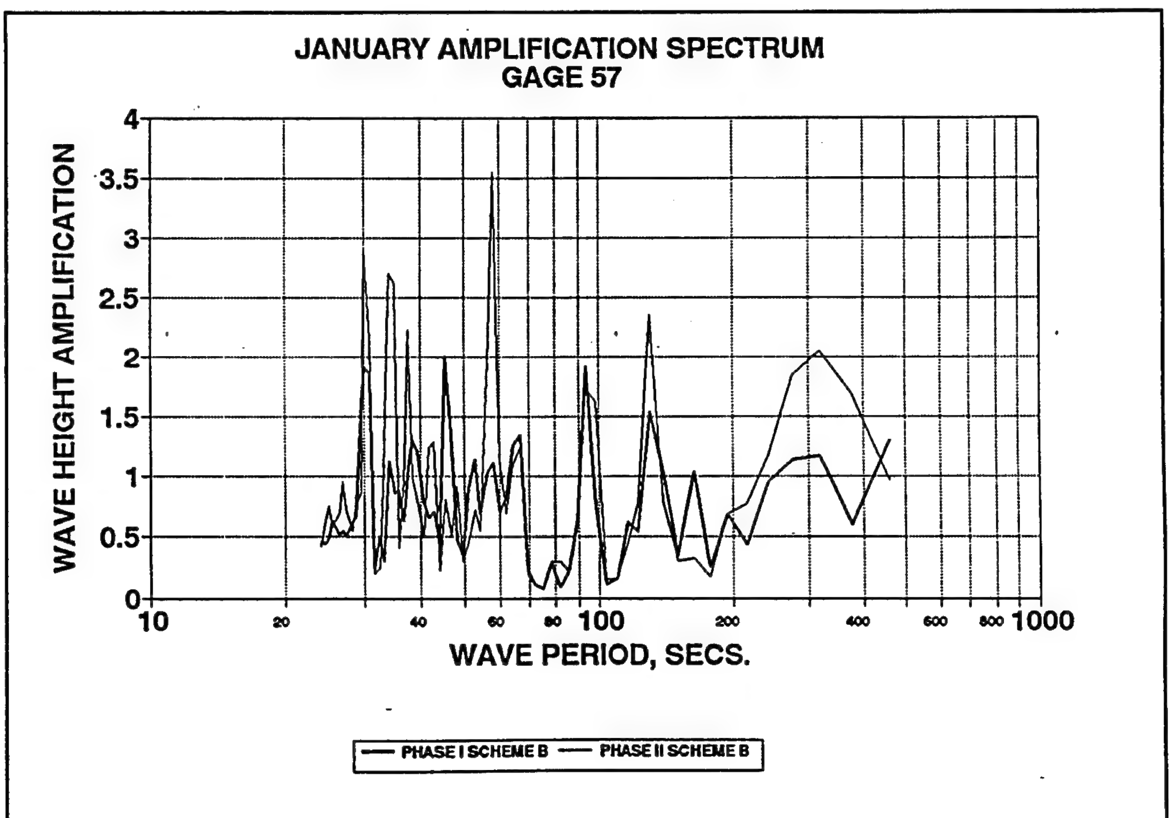

JANUARY AMPLIFICATION SPECTRUM
GAGE 52
WAVE HEIGHT AMPLIFICATION
0
2
4
6
8
10
12
14
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B

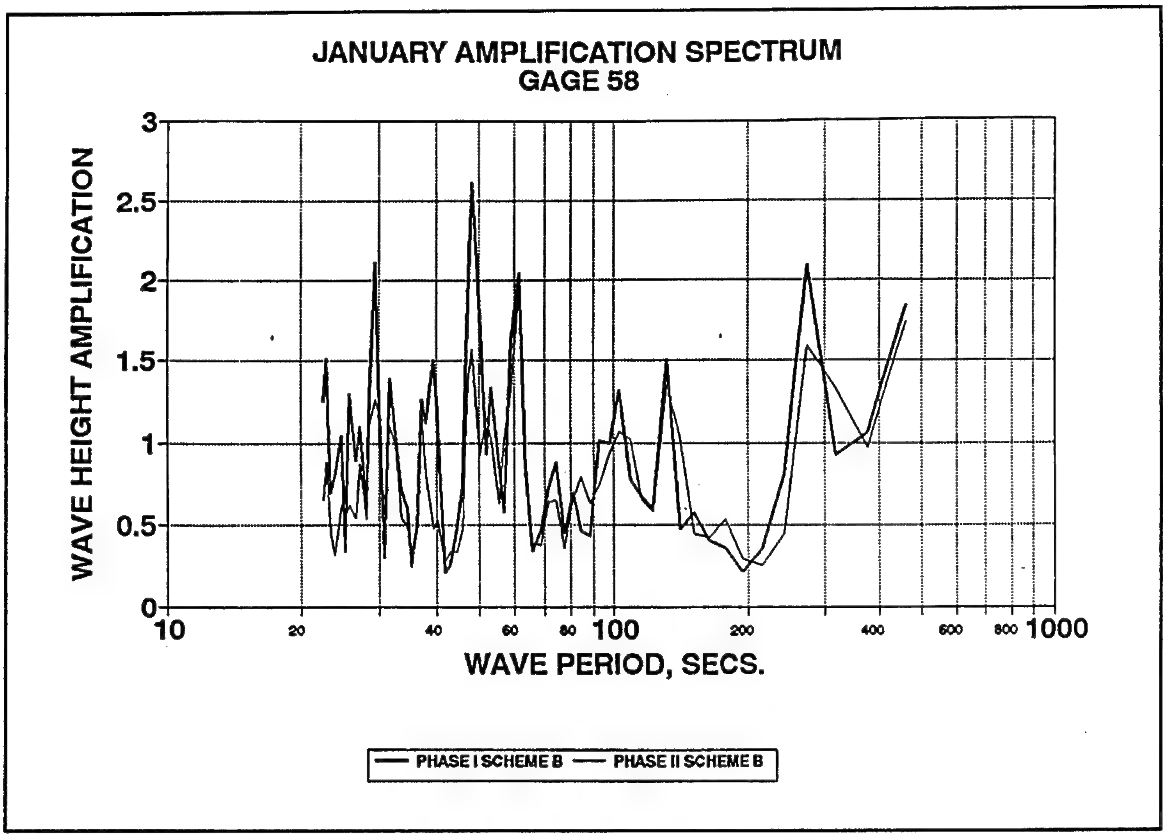

JANUARY AMPLIFICATION SPECTRUM
GAGE 53
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
7
8
9
10
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B


JANUARY AMPLIFICATION SPECTRUM
GAGE 54
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
7
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B


JANUARY AMPLIFICATION SPECTRUM
GAGE 55
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
7
8
9
10
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
BASE
PHASE I SCHEME B
PHASE II SCHEME B


JANUARY AMPLIFICATION SPECTRUM
GAGE 56
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
7
8
9
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B


JANUARY AMPLIFICATION SPECTRUM
GAGE 57
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
4
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B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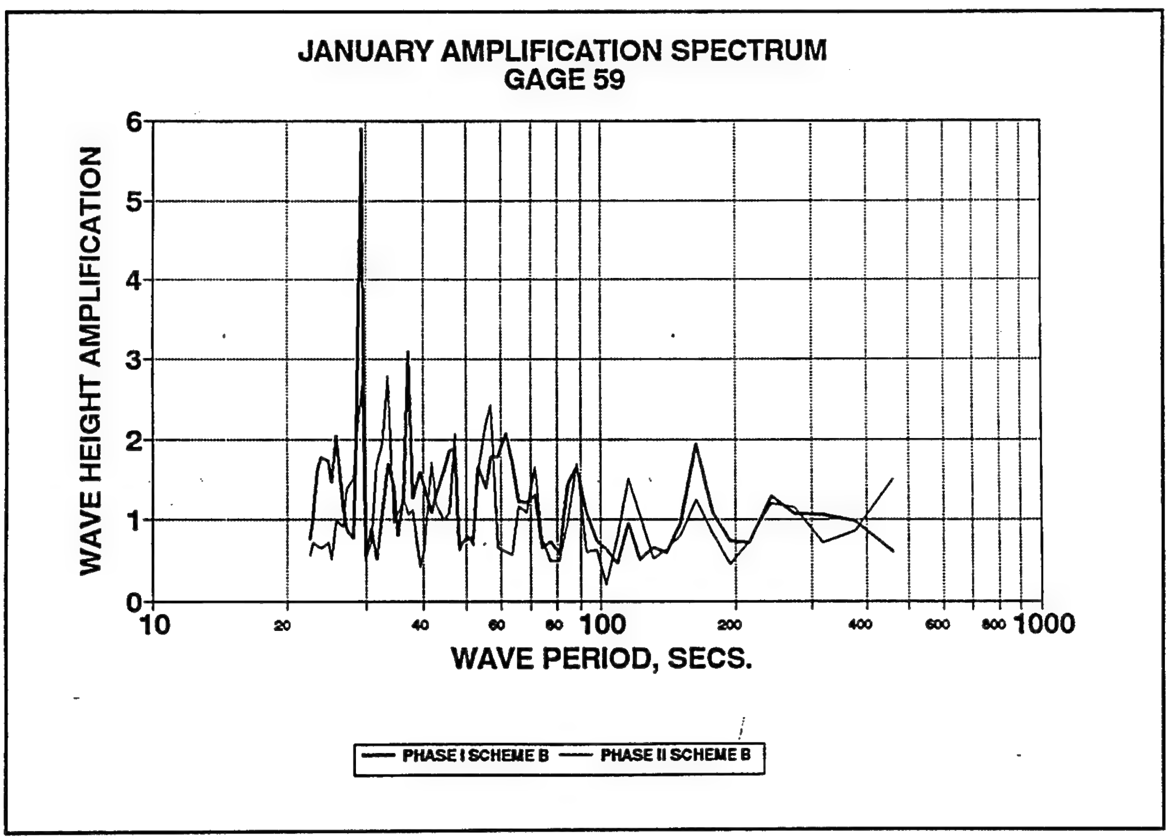
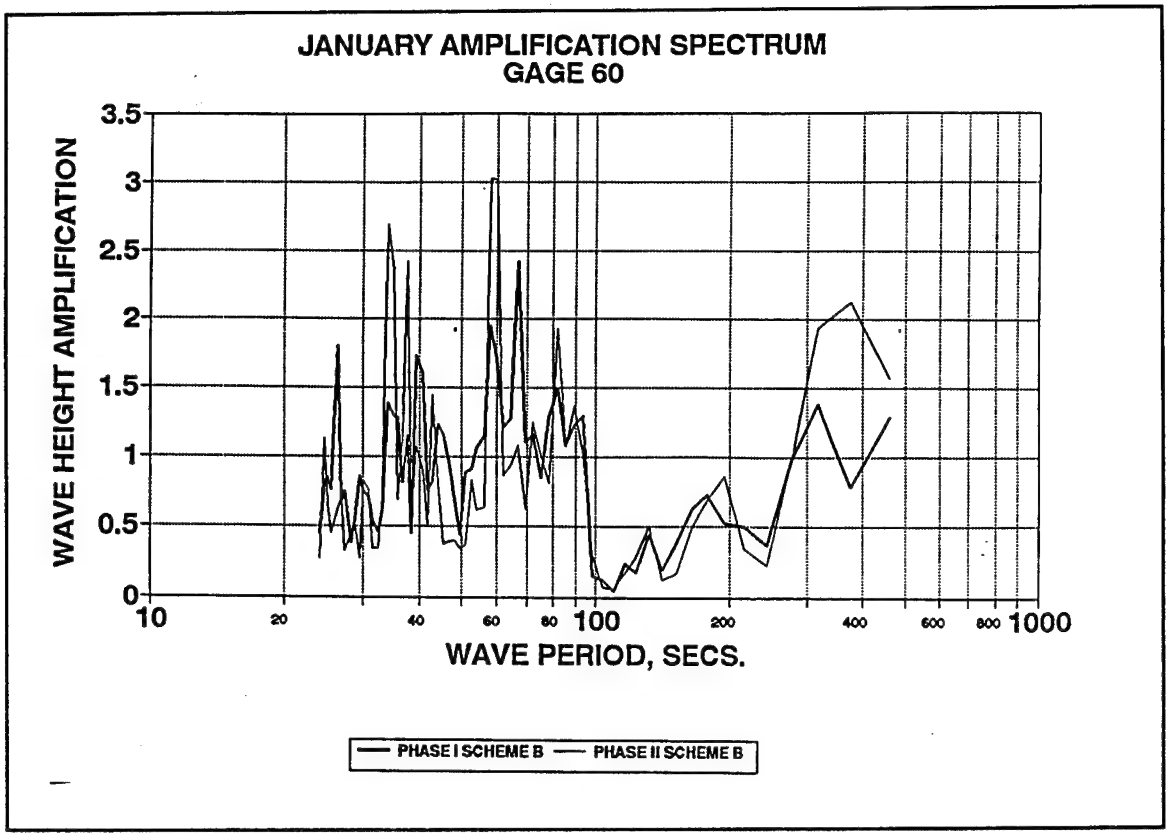
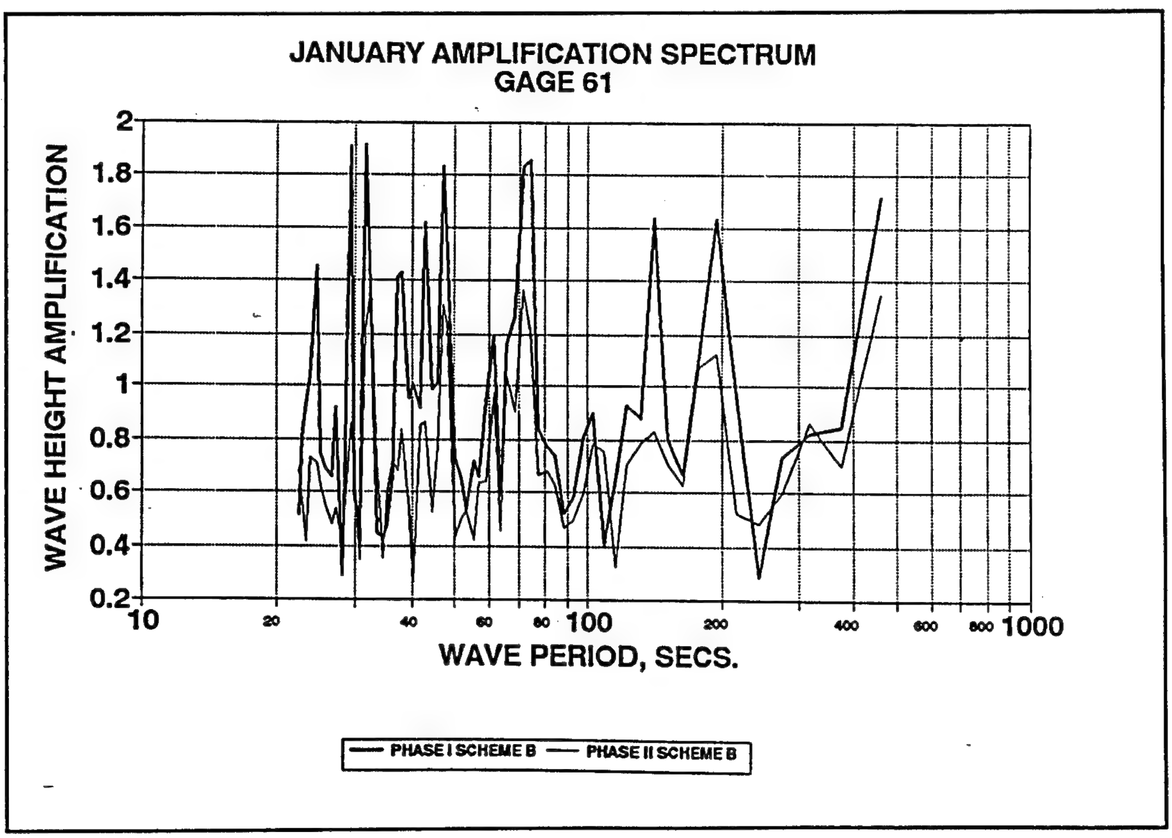
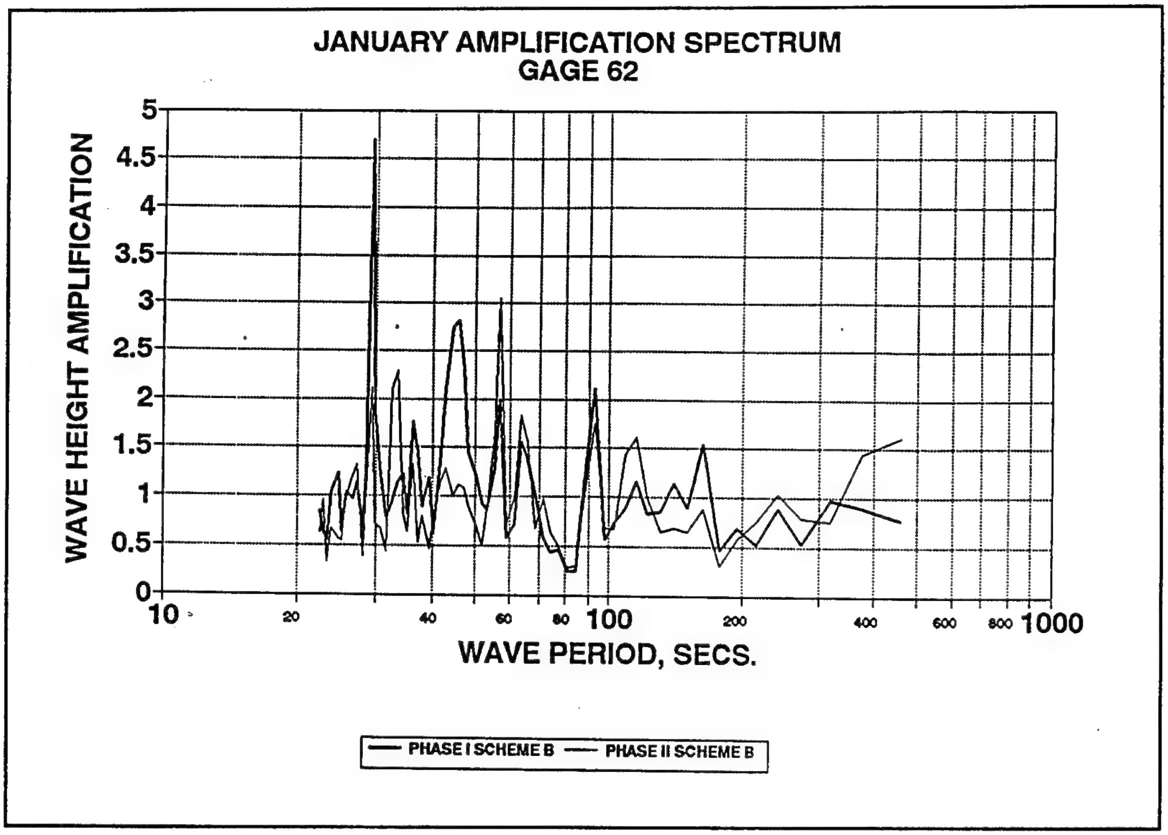
GAGE 58
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

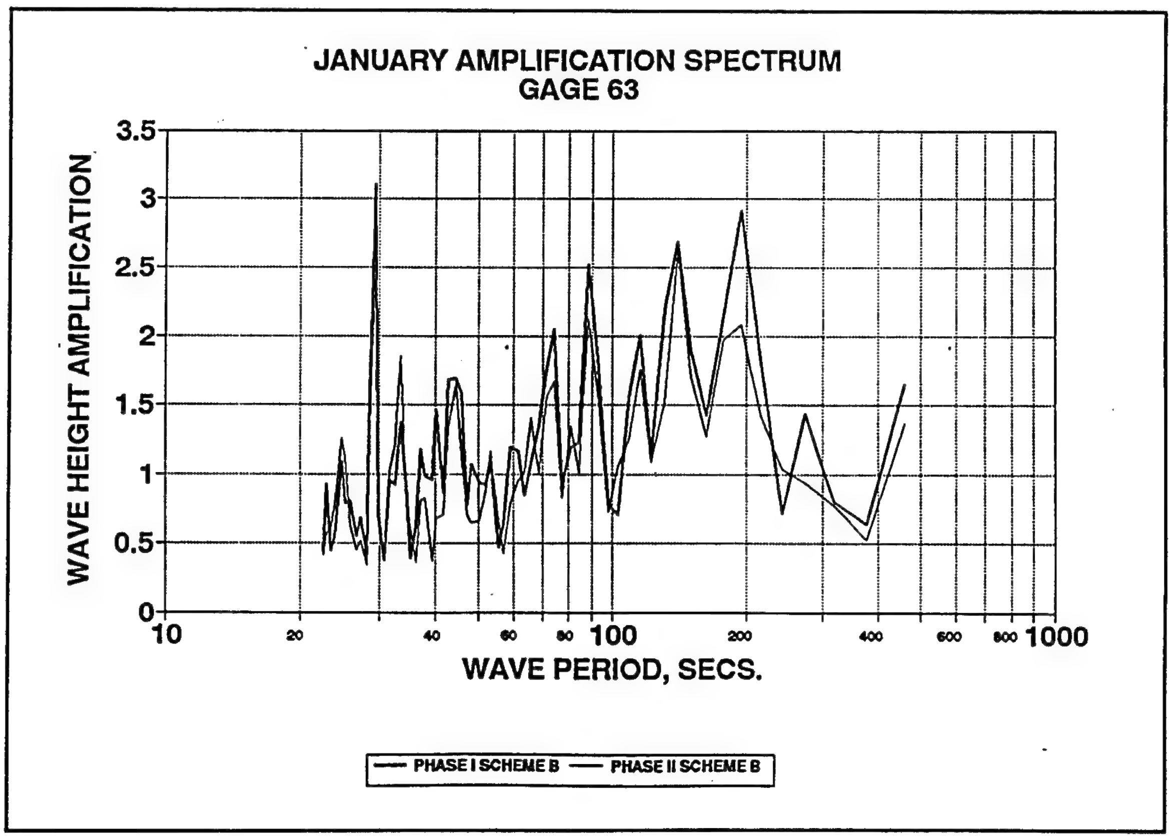

JANUARY AMPLIFICATION SPECTRUM
GAGE 59
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B


JANUARY AMPLIFICATION SPECTRUM
GAGE 60
WAVE HEIGHT AMPLIFICATION
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

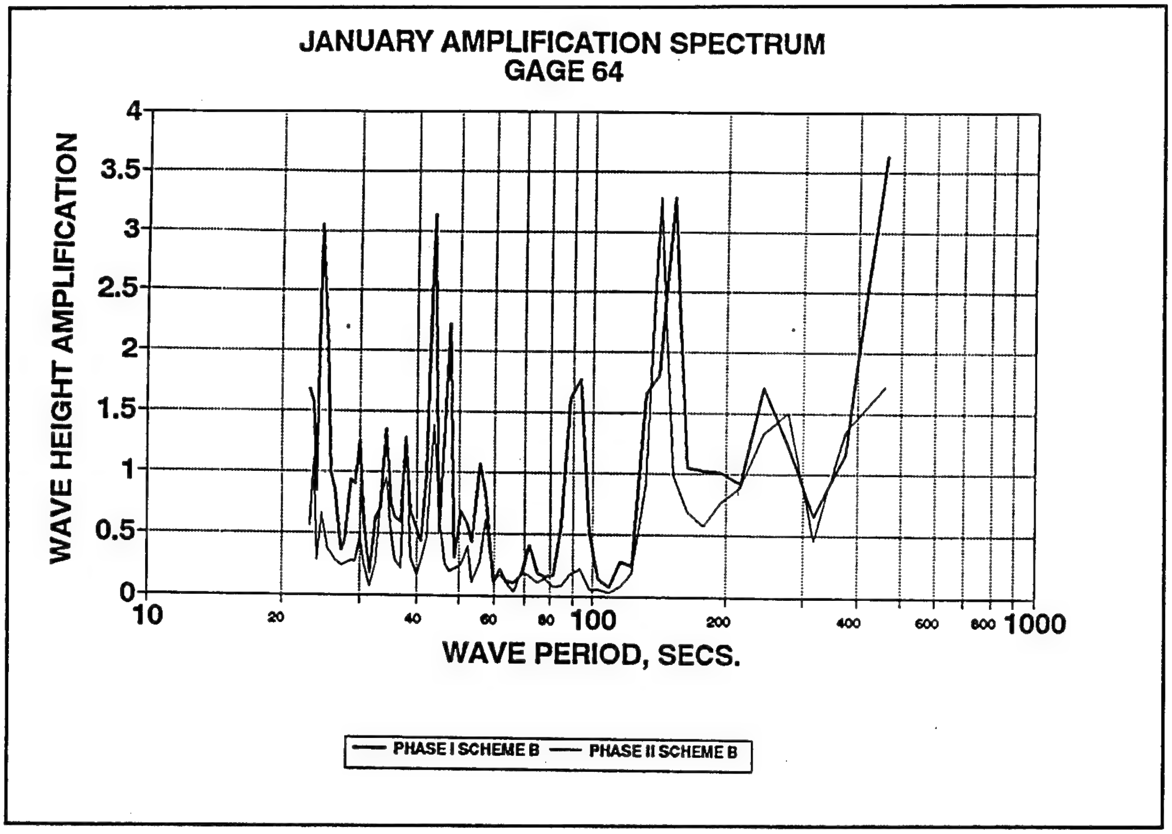

JANUARY AMPLIFICATION SPECTRUM
GAGE 61
WAVE HEIGHT AMPLIFICATION
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B



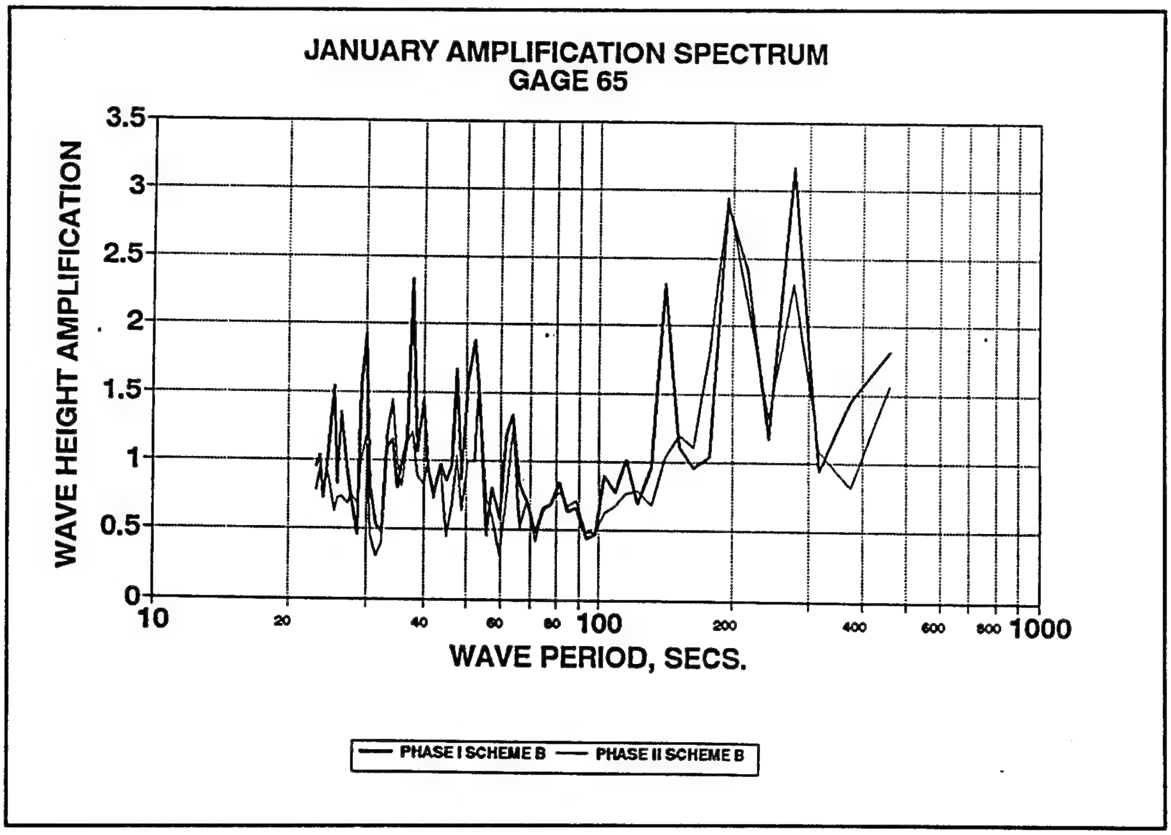
JANUARY AMPLIFICATION SPECTRUM
GAGE 62
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

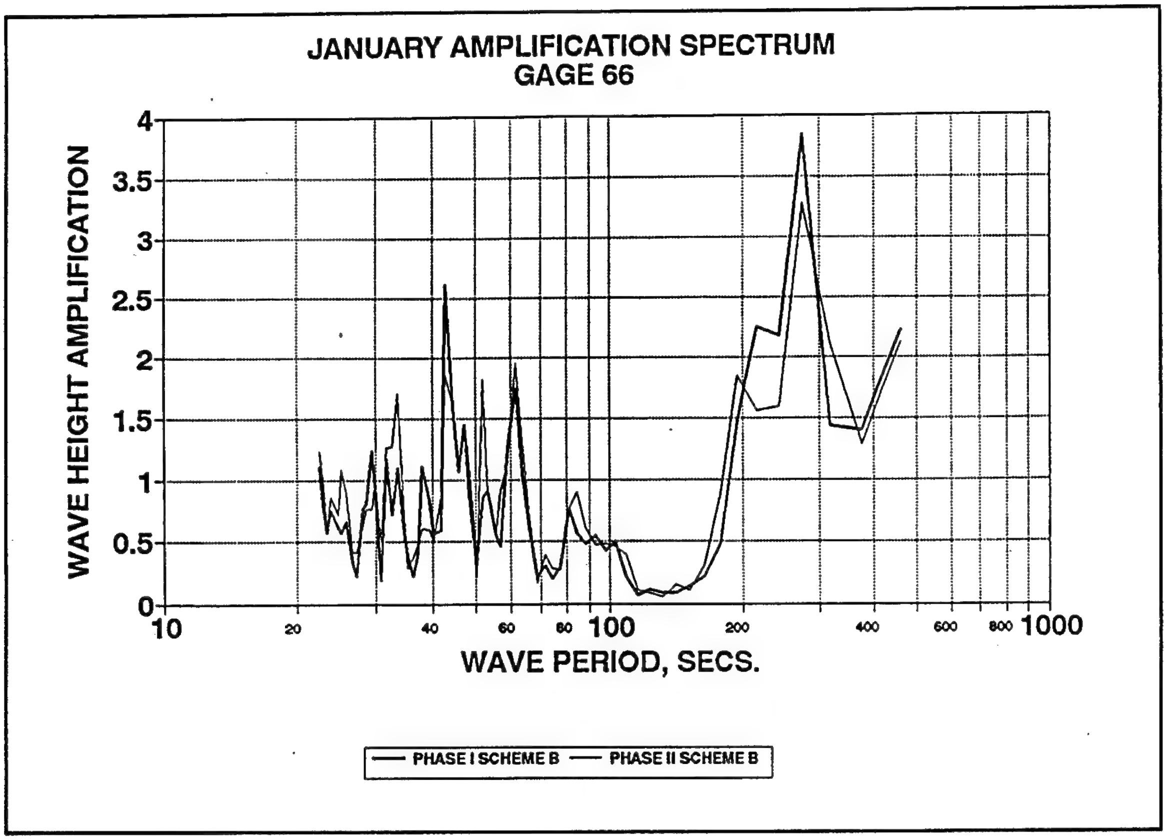
JANUARY AMPLIFICATION SPECTRUM
GAGE 63
WAVE HEIGHT AMPLIFICATION
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

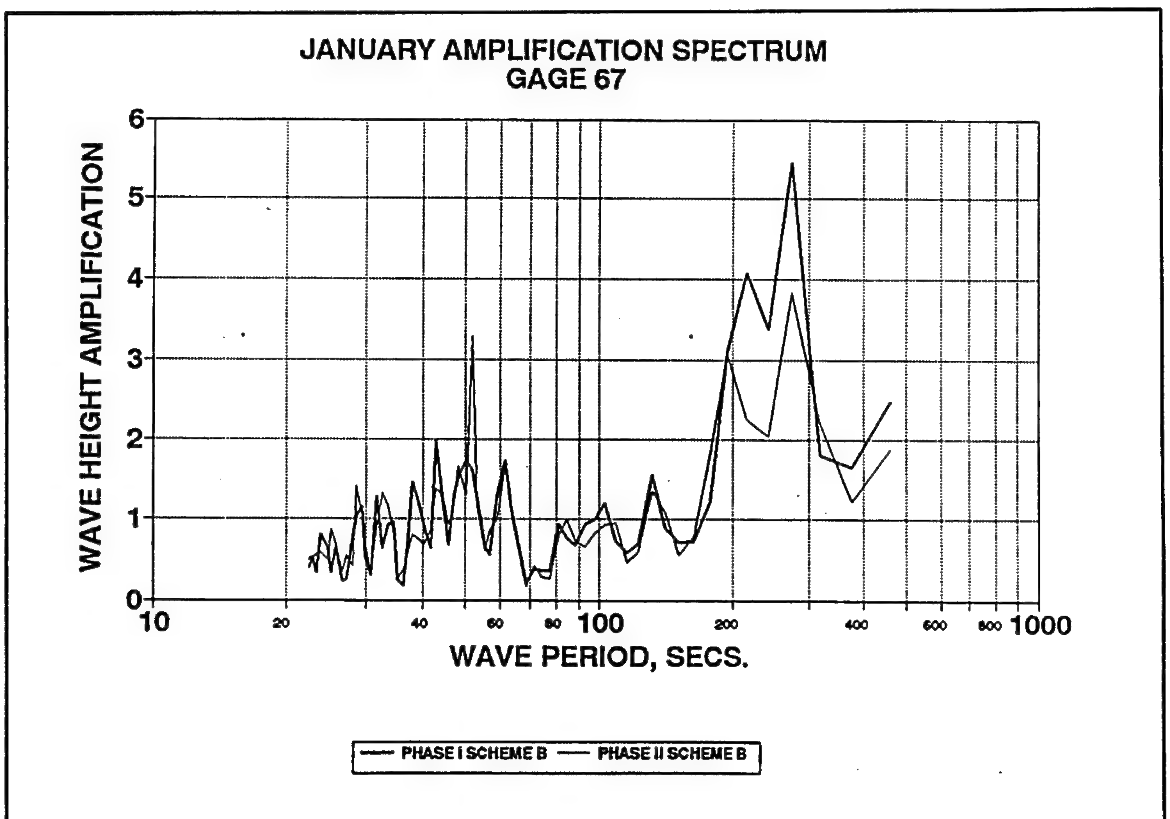


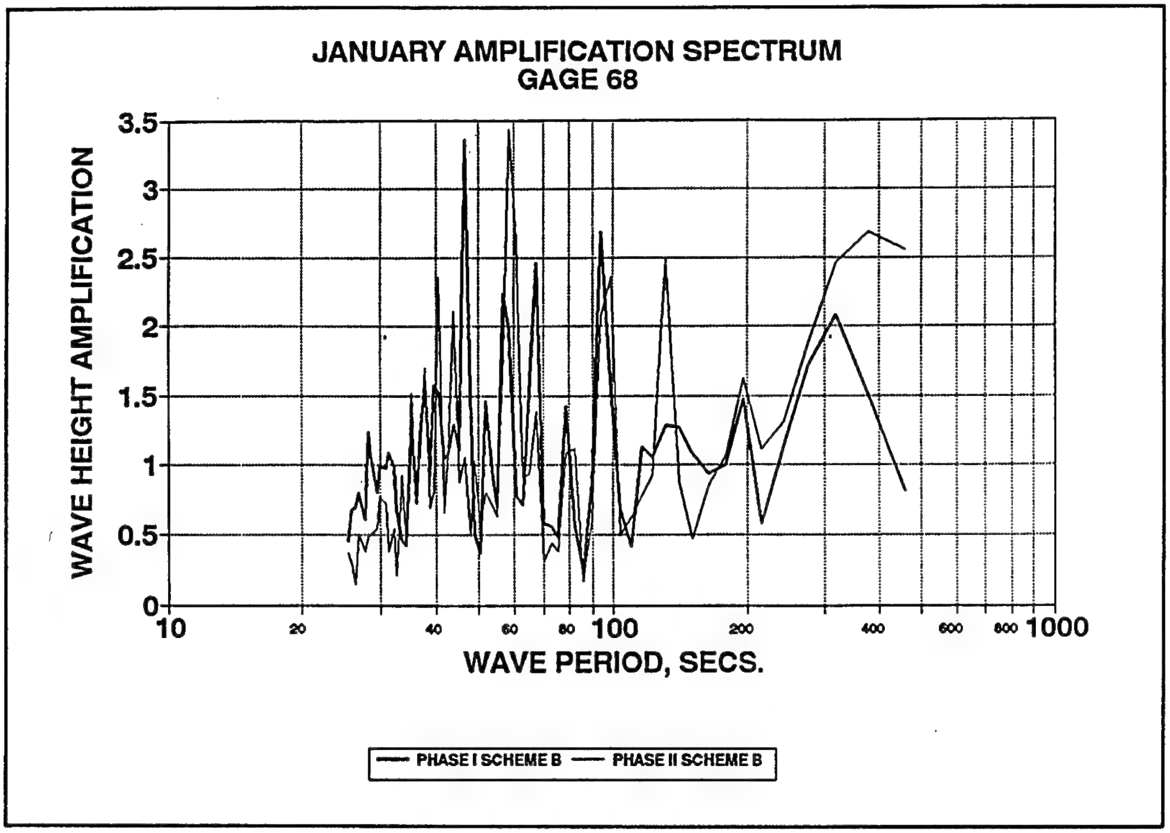
JANUARY AMPLIFICATION SPECTRUM
GAGE 64
WAVE HEIGHT AMPLIFICATION
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

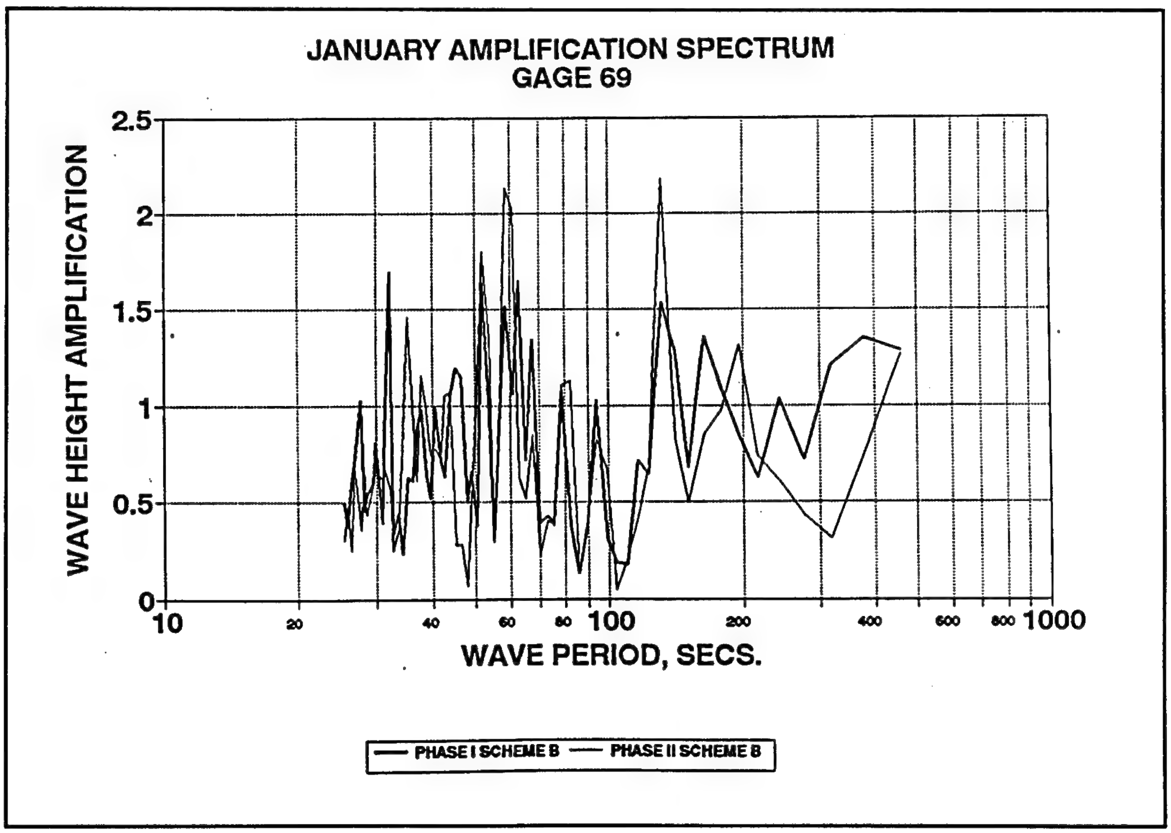



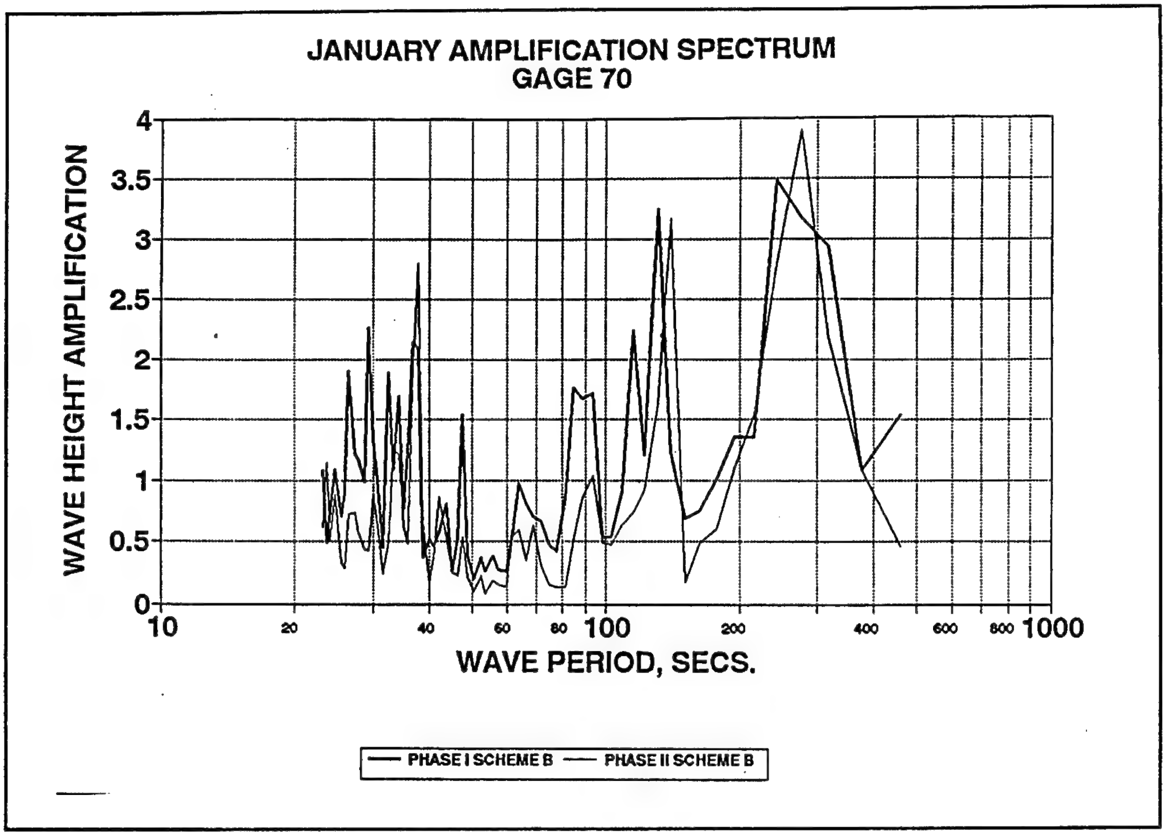
JANUARY AMPLIFICATION SPECTRUM
GAGE 65
WAVE HEIGHT AMPLIFICATION
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

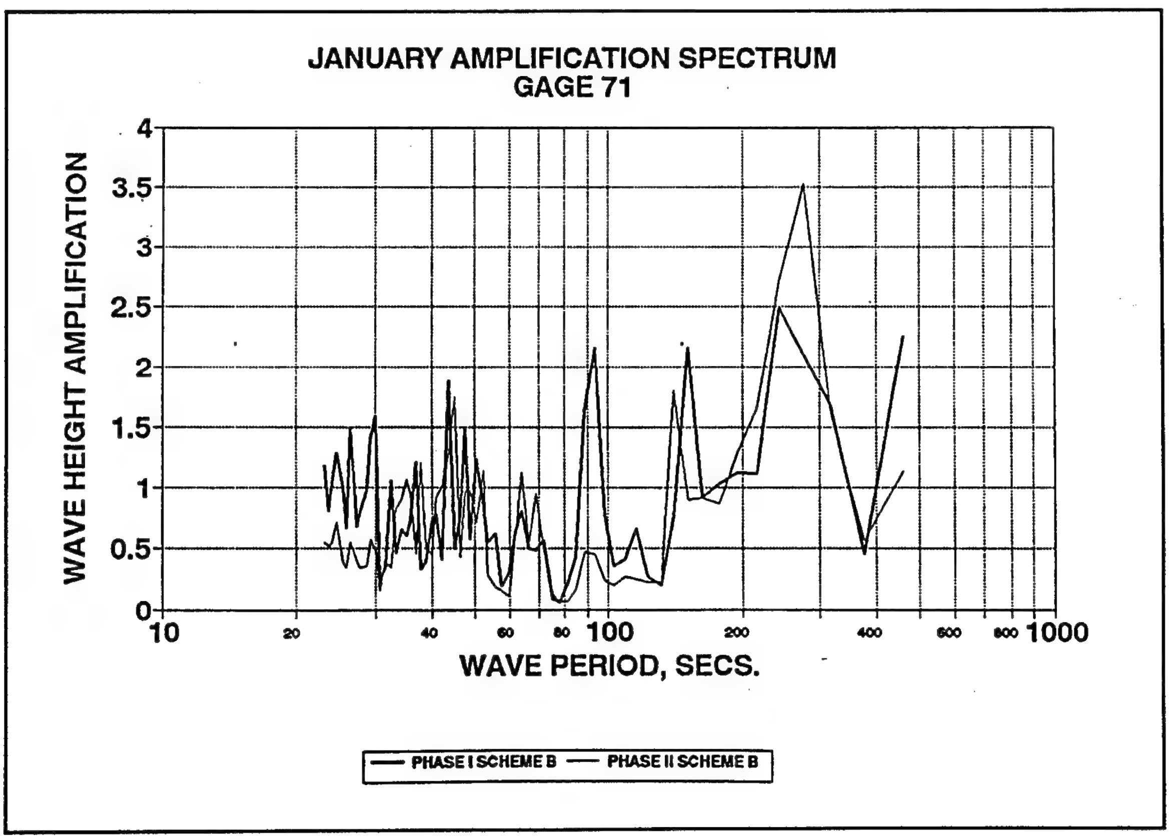

JANUARY AMPLIFICATION SPECTRUM
GAGE 66
WAVE HEIGHT AMPLIFICATION
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

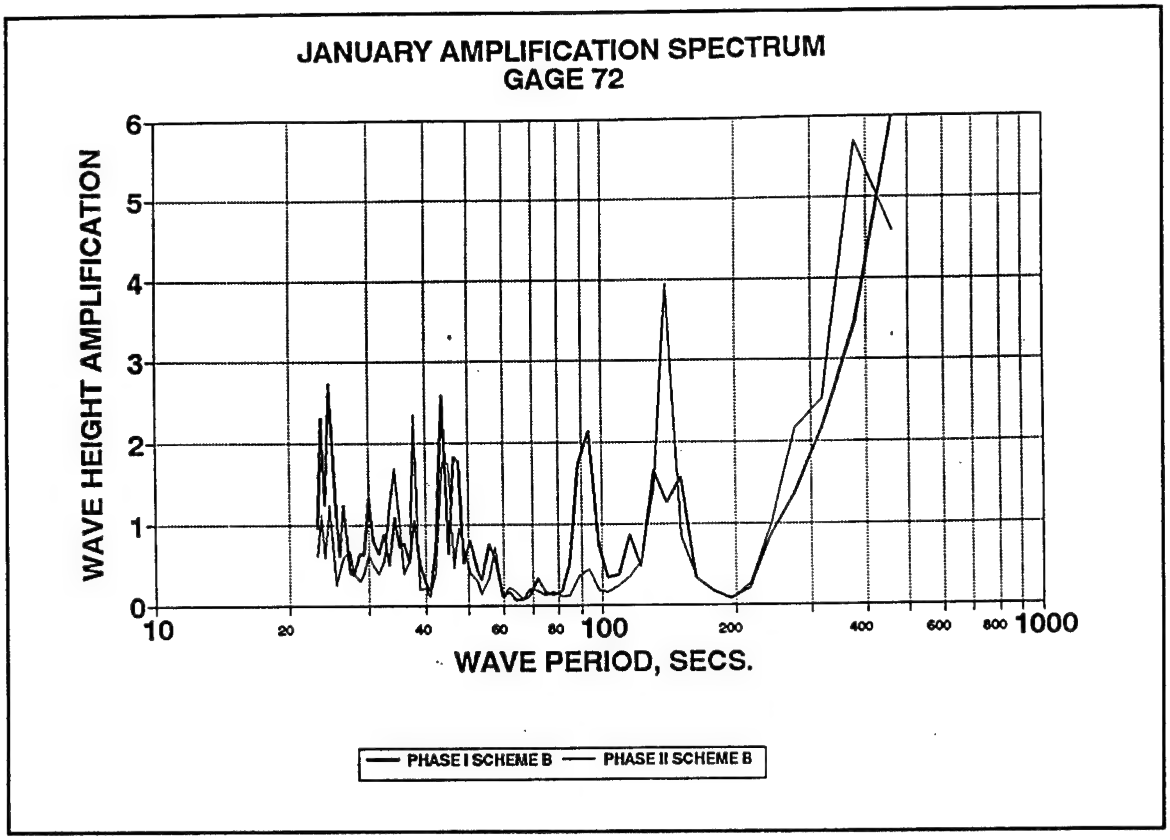

JANUARY AMPLIFICATION SPECTRUM
GAGE 67
WAVE HEIGHT AMPLIFICATION
6
5
4
3
2
1
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

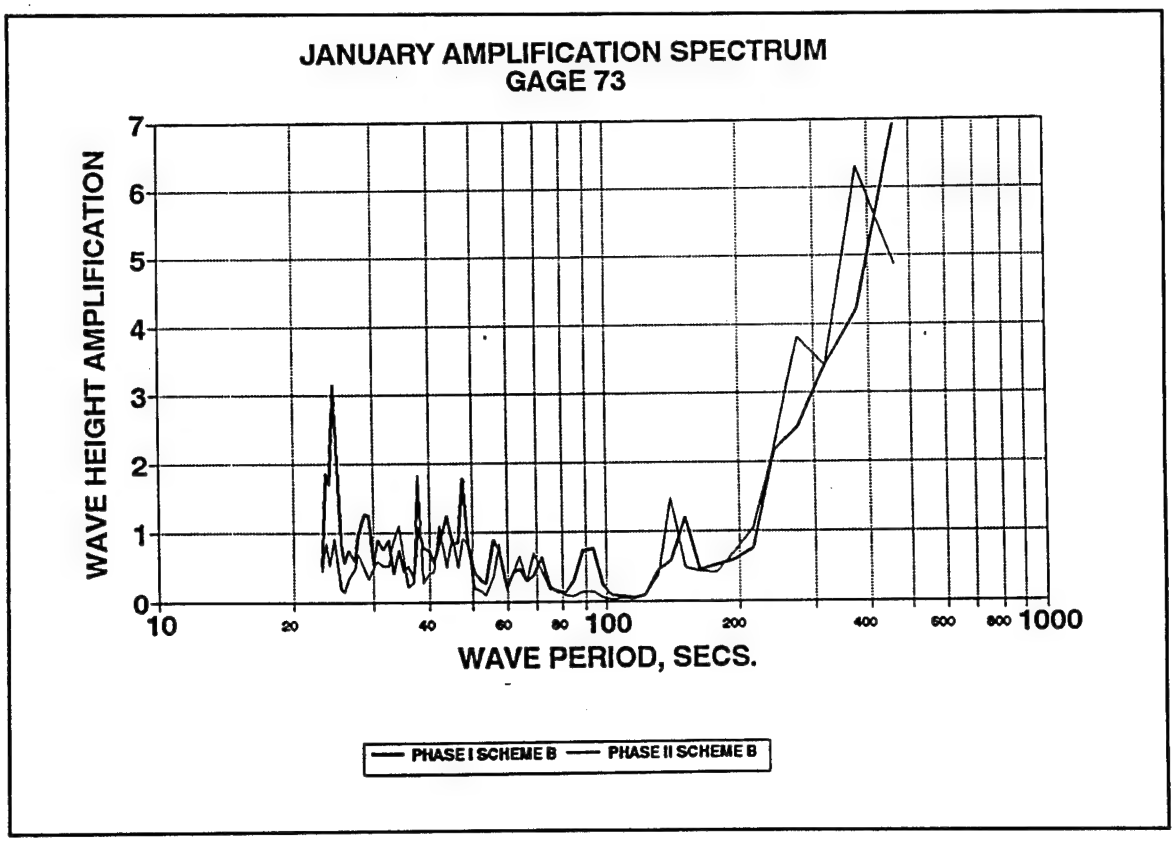

JANUARY AMPLIFICATION SPECTRUM
GAGE 68
WAVE HEIGHT AMPLIFICATION
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

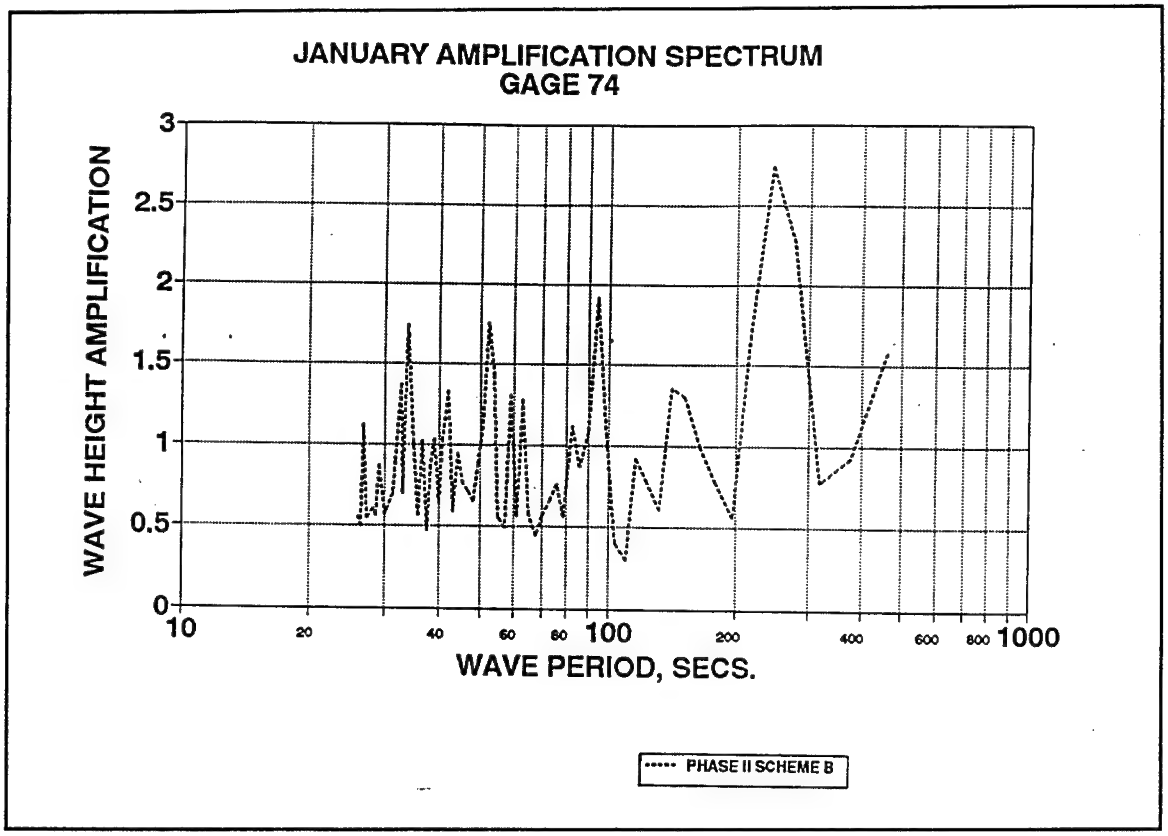

JANUARY AMPLIFICATION SPECTRUM
GAGE 69
WAVE HEIGHT AMPLIFICATION
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

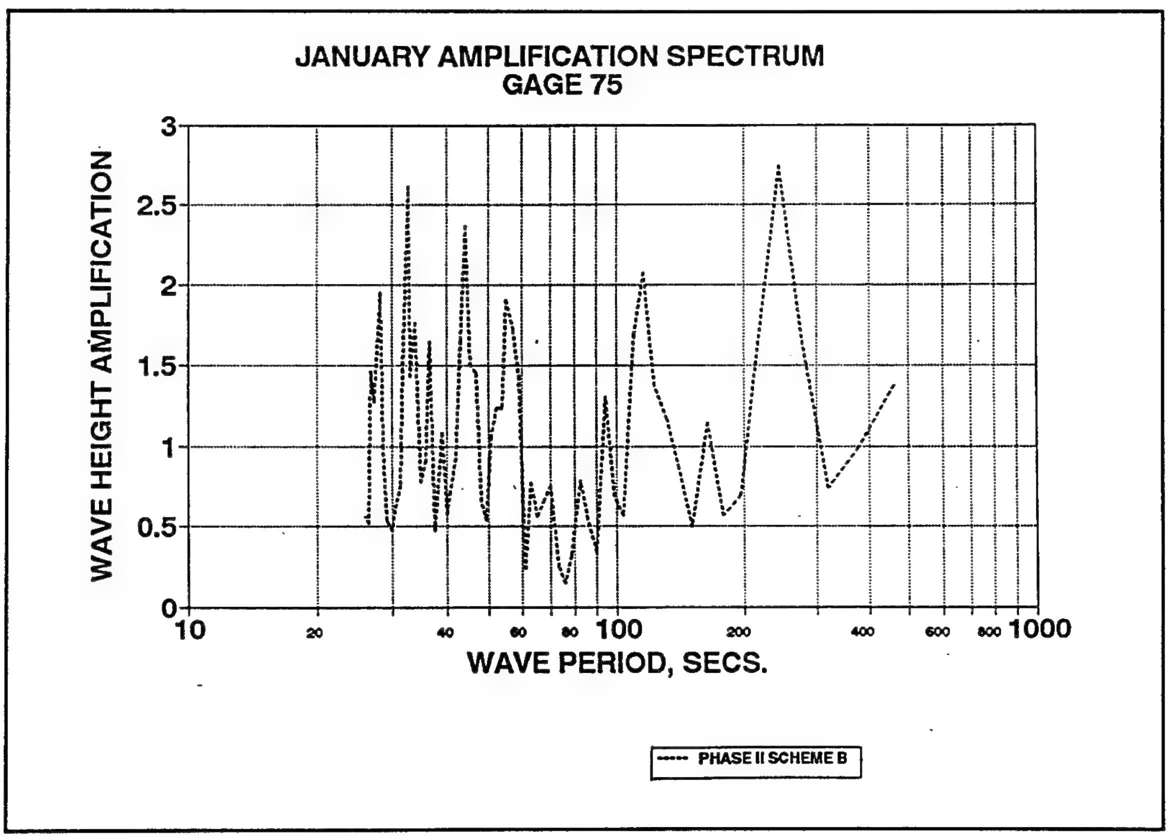

JANUARY AMPLIFICATION SPECTRUM
GAGE 70
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
4
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

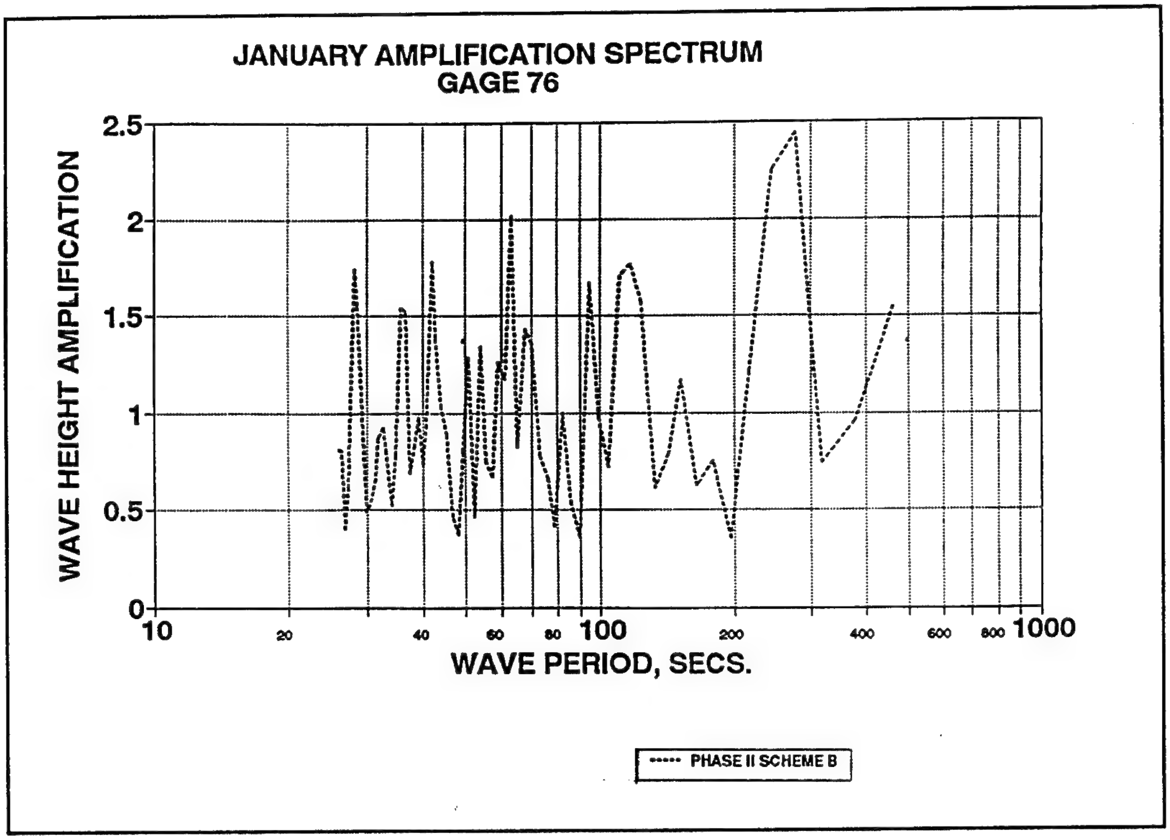

JANUARY AMPLIFICATION SPECTRUM
GAGE 71
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
4
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B


JANUARY AMPLIFICATION SPECTRUM
GAGE 72
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B

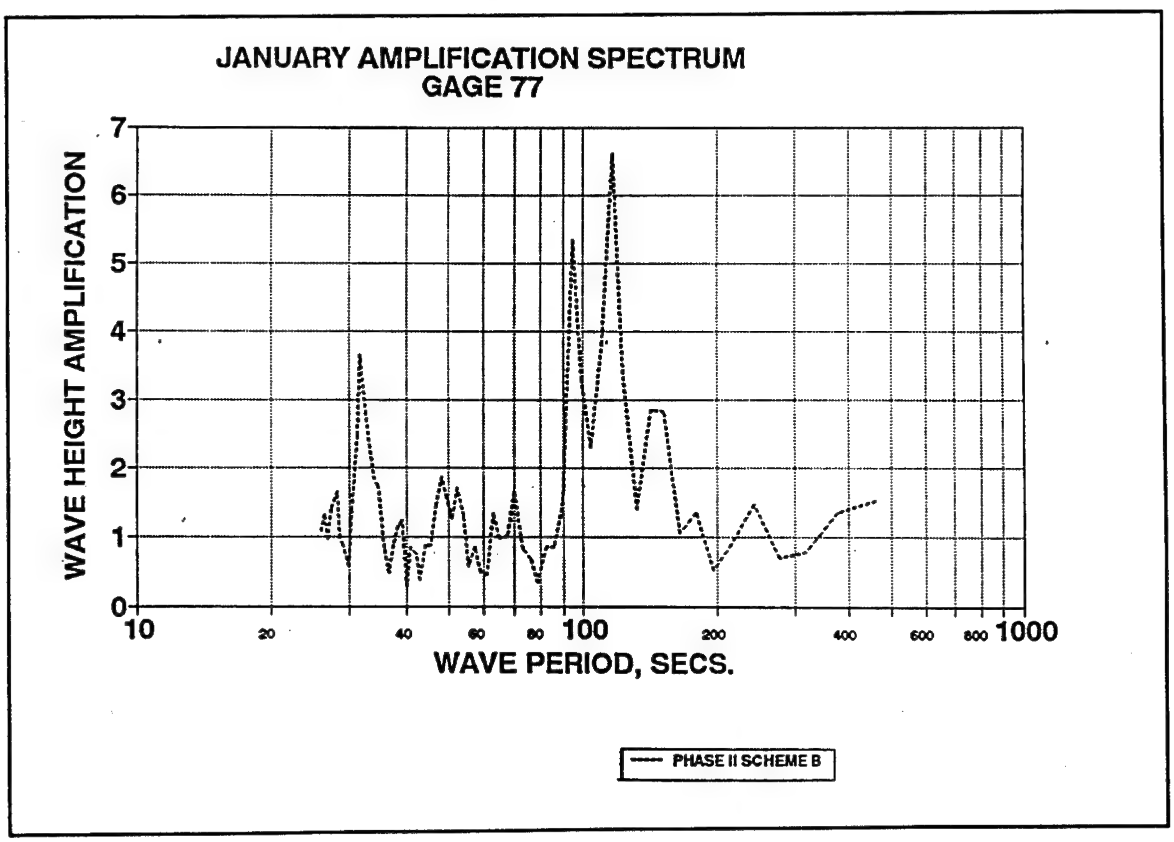

JANUARY AMPLIFICATION SPECTRUM
GAGE 73
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
7
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE I SCHEME B
PHASE II SCHEME B


JANUARY AMPLIFICATION SPECTRUM
GAGE 74
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B

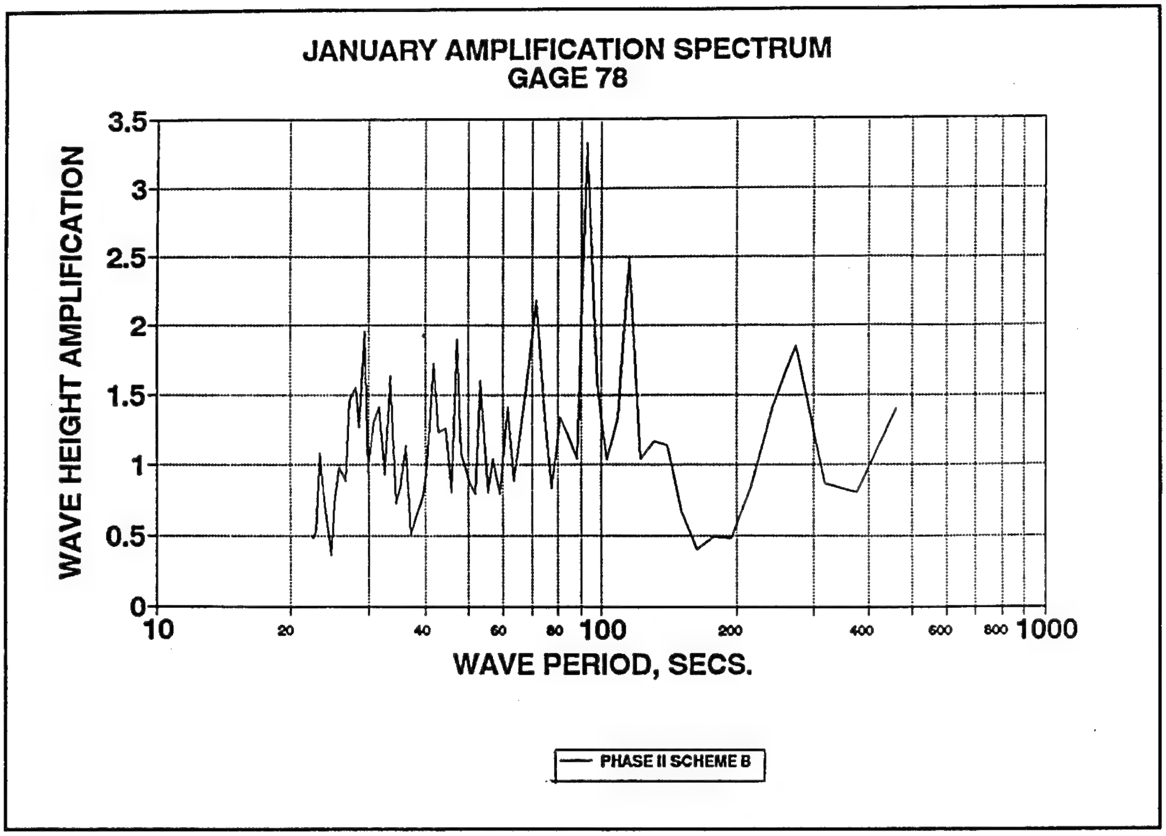

JANUARY AMPLIFICATION SPECTRUM
GAGE 75
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B

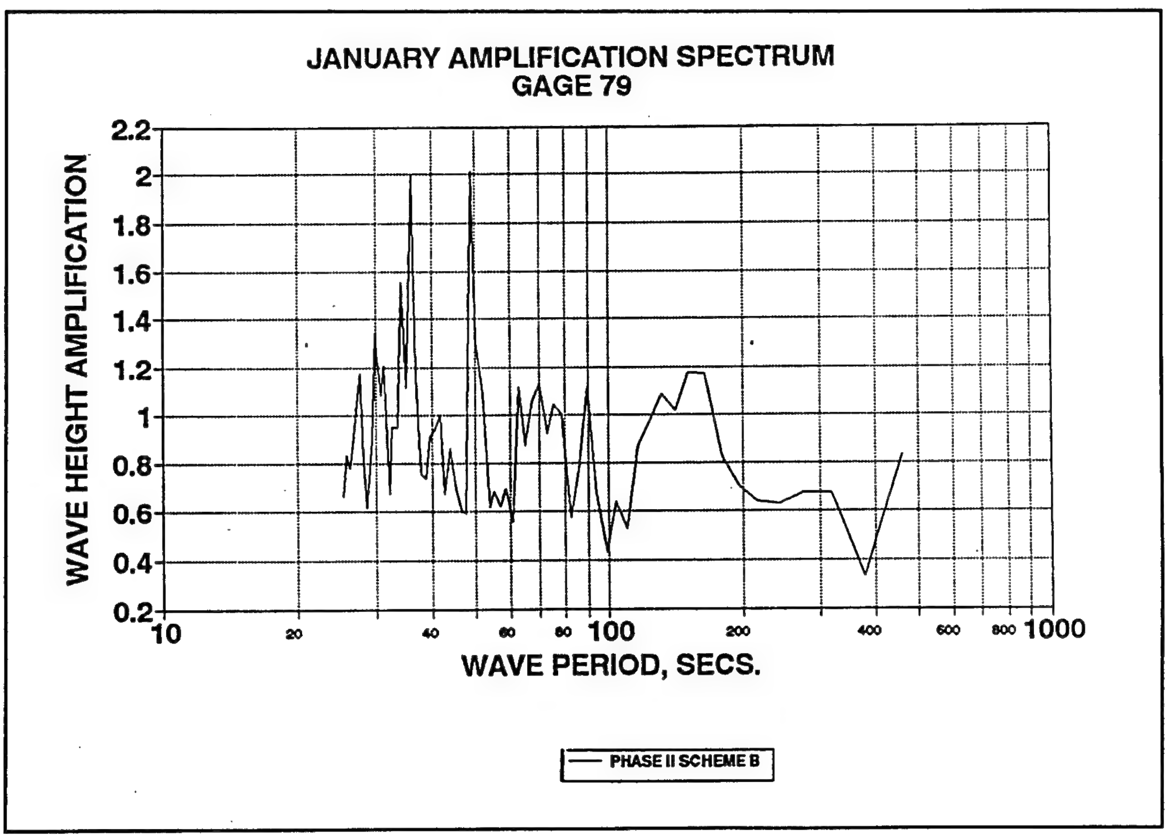


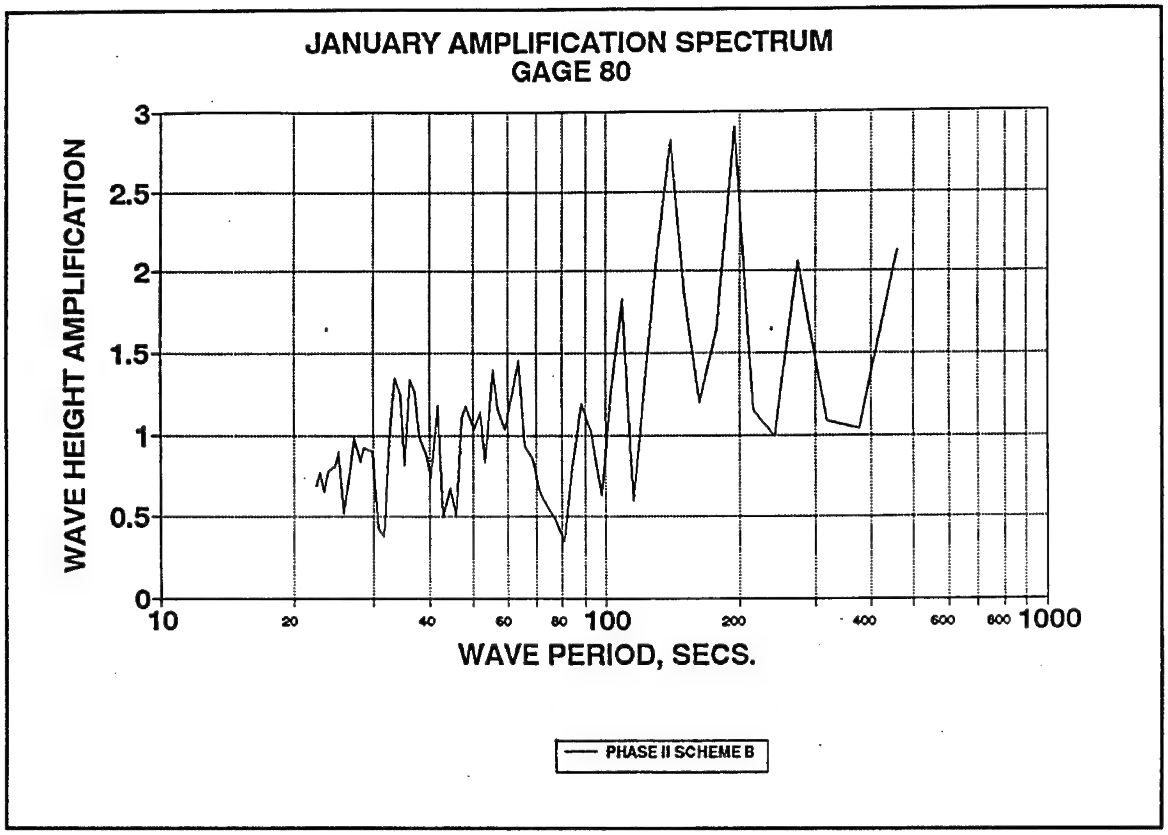
JANUARY AMPLIFICATION SPECTRUM
GAGE 76
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B

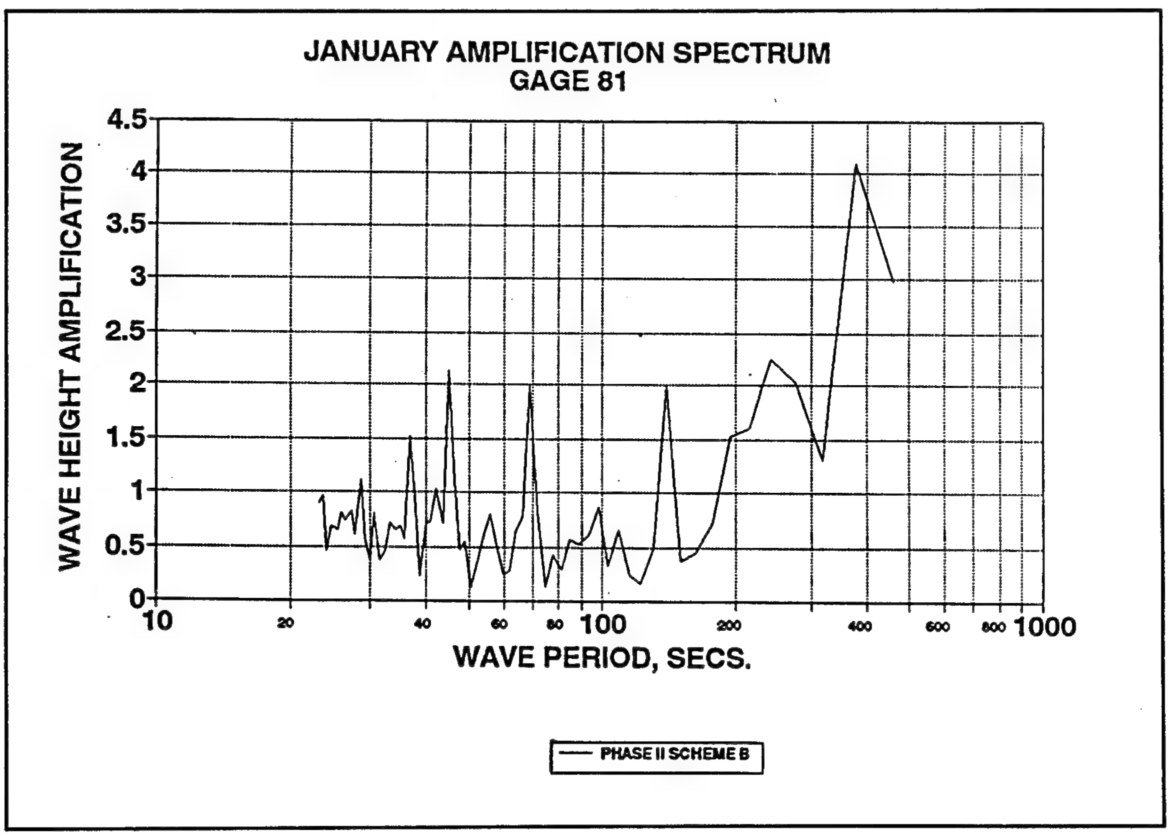
JANUARY AMPLIFICATION SPECTRUM
GAGE 77
WAVE HEIGHT AMPLIFICATION
0
1
2
3
4
5
6
7
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B


JANUARY AMPLIFICATION SPECTRUM
GAGE 78
WAVE HEIGHT AMPLIFICATION
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B

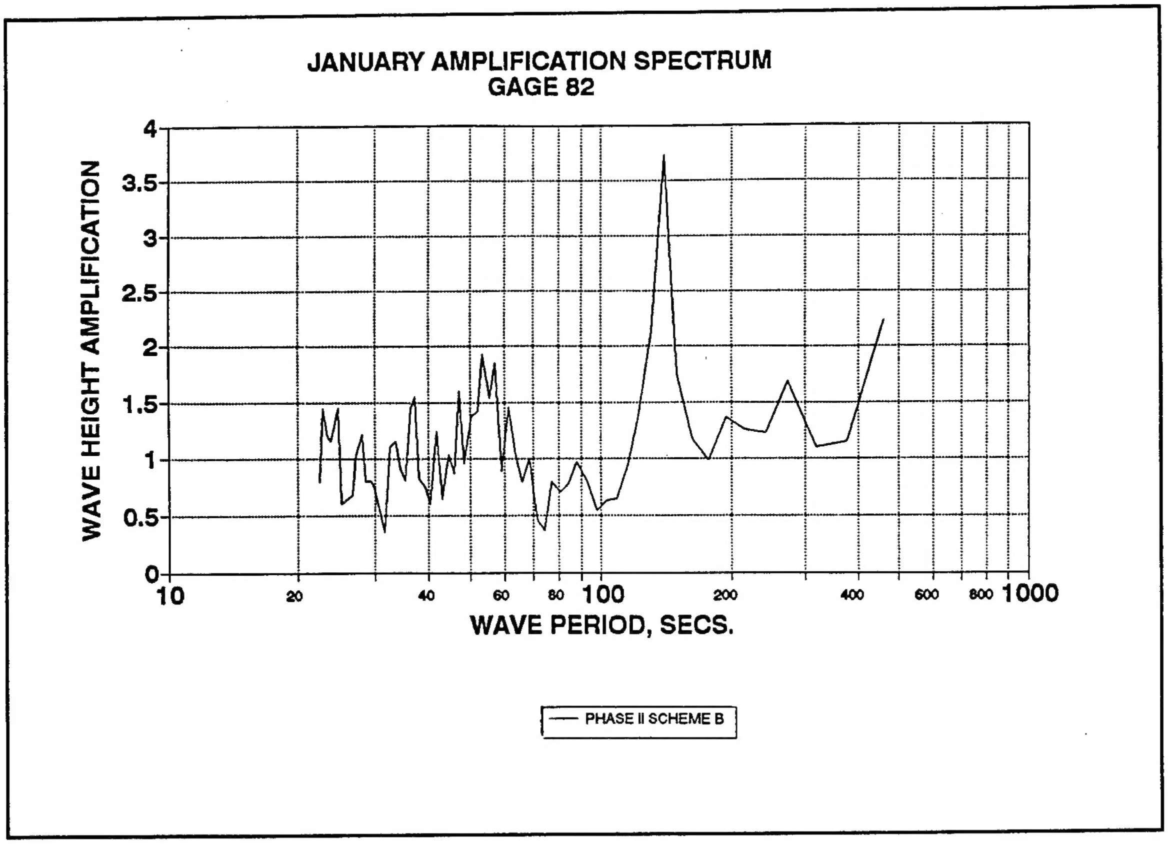

JANUARY AMPLIFICATION SPECTRUM
GAGE 79
WAVE HEIGHT AMPLIFICATION
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B

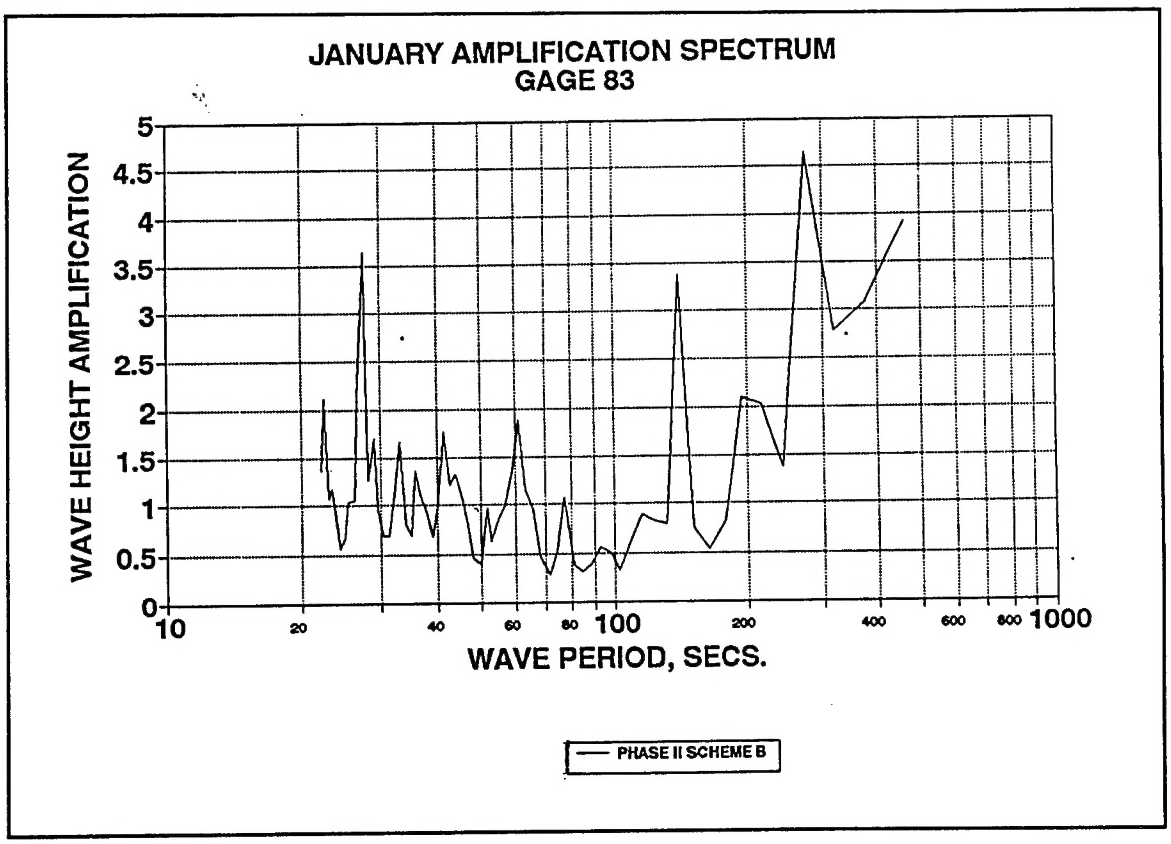


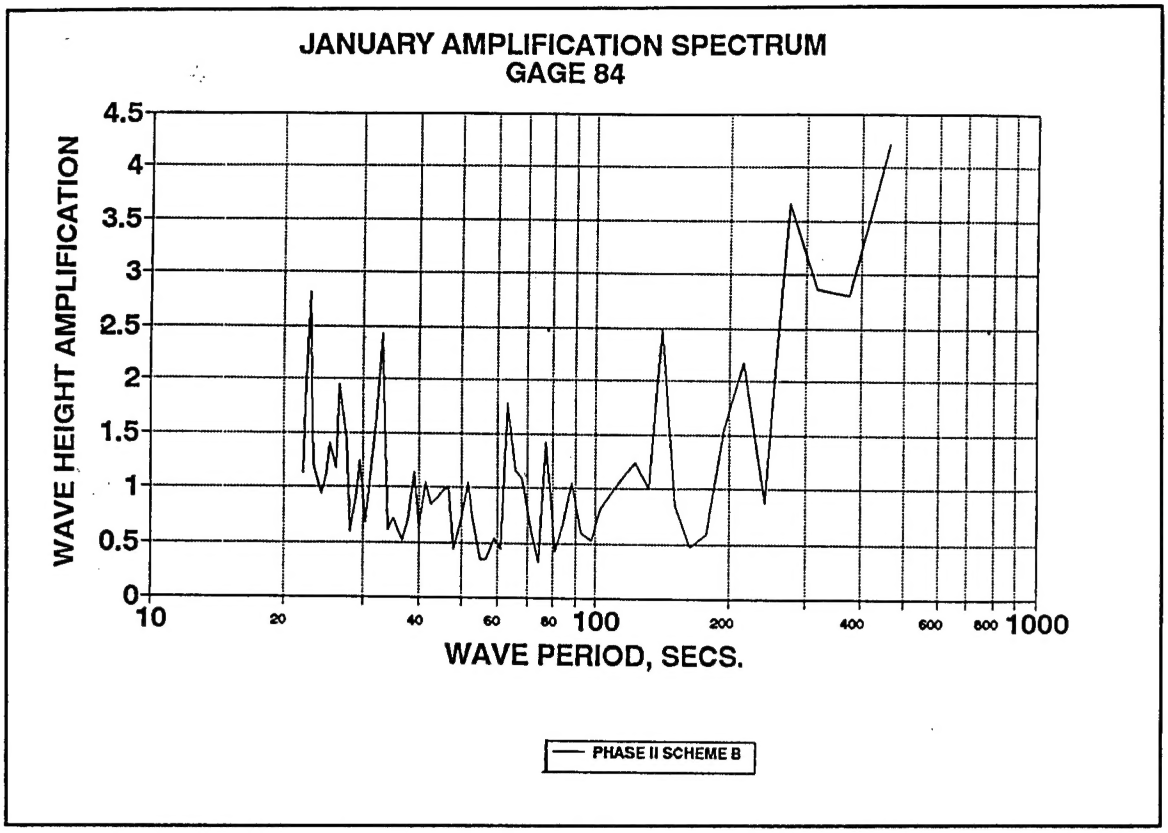
JANUARY AMPLIFICATION SPECTRUM
GAGE 80
WAVE HEIGHT AMPLIFICATION
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B

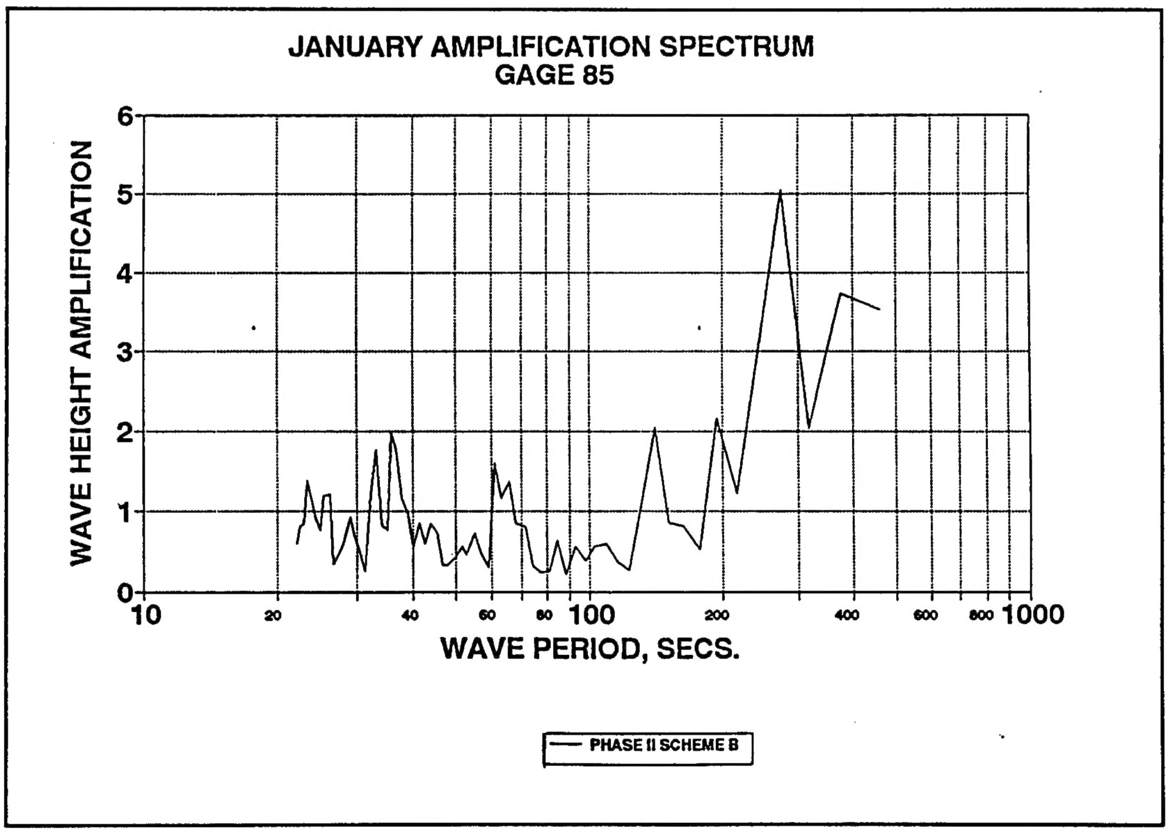
JANUARY AMPLIFICATION SPECTRUM
GAGE 81
WAVE HEIGHT AMPLIFICATION
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B


JANUARY AMPLIFICATION SPECTRUM
GAGE 82
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
4
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B

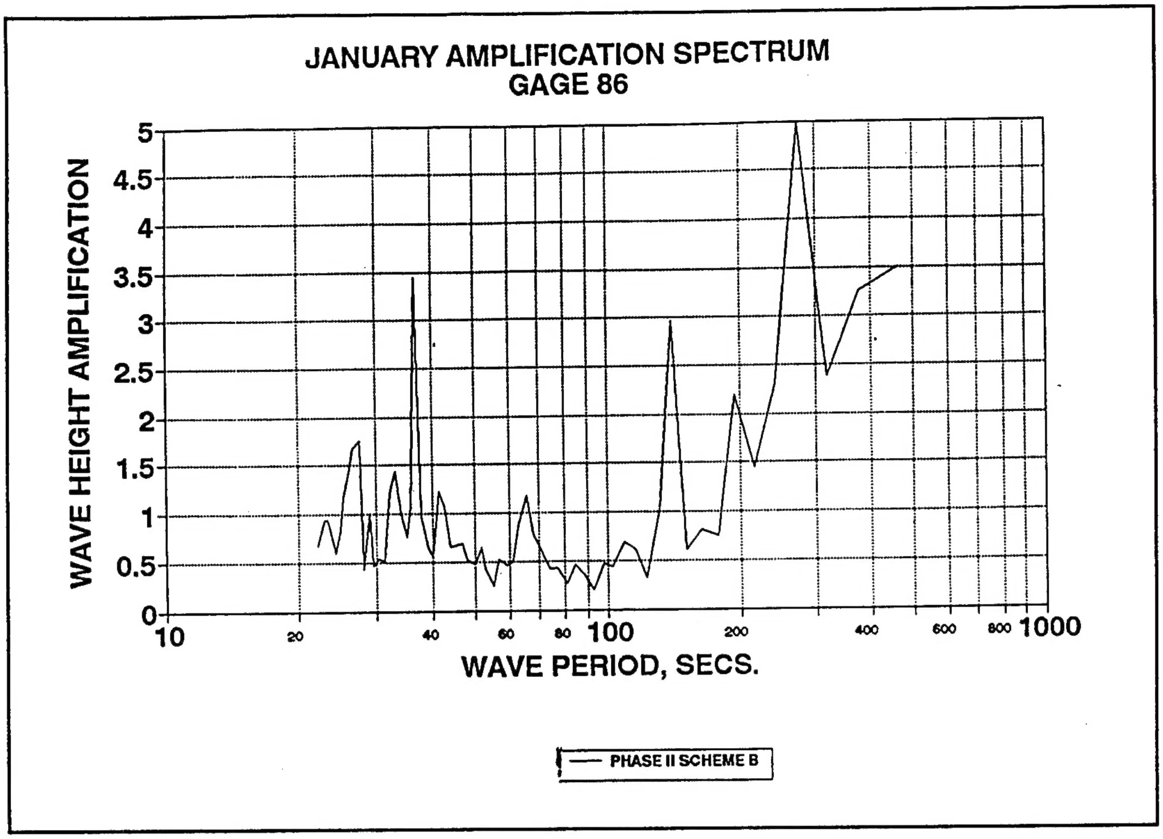

JANUARY AMPLIFICATION SPECTRUM
GAGE 83
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B

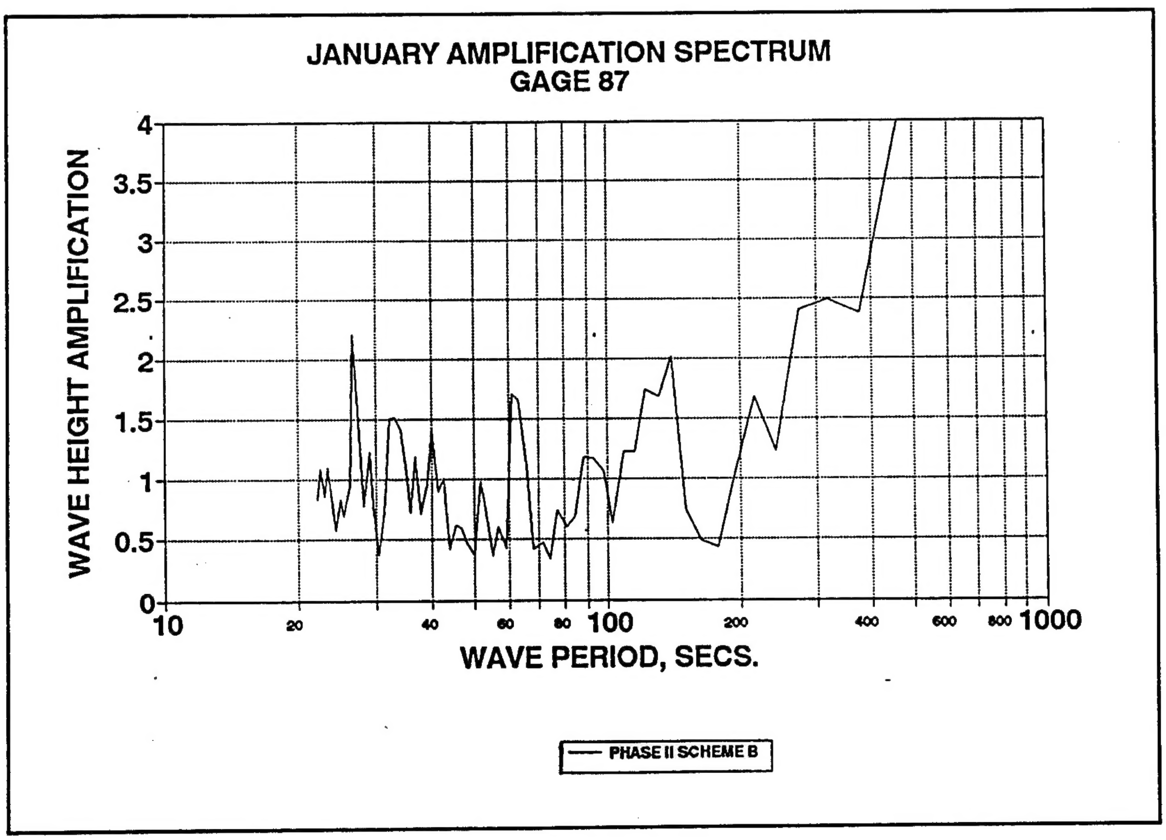


JANUARY AMPLIFICATION SPECTRUM
GAGE 84
WAVE HEIGHT AMPLIFICATION
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B

JANUARY AMPLIFICATION SPECTRUM
GAGE 85
WAVE HEIGHT AMPLIFICATION
6
5
4
3
2
1
0
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B


JANUARY AMPLIFICATION SPECTRUM
GAGE 86
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B


JANUARY AMPLIFICATION SPECTRUM
GAGE 87
WAVE HEIGHT AMPLIFICATION
0
0.5
1
1.5
2
2.5
3
3.5
4
10
20
40
60
80
100
200
400
600
800
1000
WAVE PERIOD, SECS.
PHASE II SCHEME B

# REPORT DOCUMENTATION PAGE

*Form Approved*
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**1. AGENCY USE ONLY** *(Leave blank)*

**2. REPORT DATE**
September 1995

**3. REPORT TYPE AND DATES COVERED**
Final report

**4. TITLE AND SUBTITLE**
Los Angeles and Long Beach Harbors, Physical Model Study for Harbor Resonance of the Operations, Facilities, and Infrastructure, Scheme B, 2020 Plan

**5. FUNDING NUMBERS**

**6. AUTHOR(S)**
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**7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)**
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**8. PERFORMING ORGANIZATION REPORT NUMBER**
Technical Report CERC-95-15

**9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)**
Port of Los Angeles
San Pedro, California 90733-0151

Port of Long Beach
Long Beach, California 90801-0570

**10. SPONSORING/MONITORING AGENCY REPORT NUMBER**

**11. SUPPLEMENTARY NOTES**
Available from National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161

**12a. DISTRIBUTION/AVAILABILITY STATEMENT**
Approved for public release;
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**12b. DISTRIBUTION CODE**

**13. ABSTRACT** *(Maximum 200 words)*

The Los Angeles - Long Beach Harbors physical model for harbor resonance was used to investigate the effects of the Operations, Facilities, and Infrastructure (OFI), Scheme B, 2020 Plan on long waves (periods 30-500 sec) at existing and proposed berth locations. Phases I and II were studied. Monochromatic and irregular long waves were programmed for the 59.5-m (195-ft) segmented wave generator which produced a variable amplitude wave front. Long period wave heights were measured at 87 gauge locations for existing and plan conditions. Long-period wave spectra representedwinter storms from the west and waves from the south (more typical of summer and early fall).

Wave measurements of harbor resonance indicated that for Los Angeles Harbor, Phases I and II, most existing harbor locations experienced reduction in wave height amplification factors (calculated relative to the ocean wave height), with only a few locations indicating slight increases, and these for relatively low amplification values. Fish Harbor and Pier 300 showed significant reduction in wave amplification. Proposed harbor berths on the new Island landfill showed good response characteristics. Maximum responses periods tended to be greater than 200 sec, where ship motion response is less significant.

**14. SUBJECT TERMS**

| | |
|---|---|
| Harbor | Long-period waves |
| Harbor resonance | Los Angeles Harbor |
| Long Beach Harbor | Physical models |

**15. NUMBER OF PAGES**
298

**16. PRICE CODE**

**17. SECURITY CLASSIFICATION OF REPORT**
UNCLASSIFIED

**18. SECURITY CLASSIFICATION OF THIS PAGE**

**19. SECURITY CLASSIFICATION OF ABSTRACT**
UNCLASSIFIED

**20. LIMITATION OF ABSTRACT**